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Authors are alone responsible for their respective statements.

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The

Geographical Journal.

No. 1. JULY, 1905. Vol. XXVI.

ADDRESS TO THE ROYAL GEOGRAPHICAL SOCIETY, 1905.*

By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S., President.

The Six Sections of our Work.

This is the last occasion on which I shall address my colleagues as President of the Society. I think, therefore, that, in treating of the various subjects which compose my address, it will be well if I look back over the twelve years during which I have been President, and do not confine myself entirely to the events of the past year.

Our work is divided into *six* sections, and certainly not the least important of these six sections is: I. The *dissemination of geographical knowledge*. We are all aware of the admirable way in which such knowledge has been disseminated during the last twelve years. The new series of our *Journal* was planned by Dr. Keltie, and commenced in 1893, when the old title of *Journal* was restored. Owing to Dr. Keltie's indefatigable research, his power of collecting information from all available sources, and his judicious editing, our *Journal* has acquired a world-wide reputation. It seems to me that it improves each month, both as regards the reading portion and the illustrations. But Dr. Keltie's services are not confined to the editorial work of the *Journal*. He edits other work bearing on geography, and gives advice and information to inquirers of all kinds. I never knew an official who stuck more resolutely to his official work, to which has recently been added the organization of the Research Department. To the President the help of Dr. Keltie is absolutely indispensable. When I put forward an idea, Dr. Keltie quickly takes it up, considers all the details, overcomes the difficulties, and makes it a reality. Such was the history of

* Read at the Anniversary Meeting, May 22, 1905.

the Elizabethan Commemoration, and of our other special meetings. It is a great advantage to the Society to have the services of such an accomplished geographer and such an indefatigable secretary as Dr. Keltie.

In the office, too, we have zealous workers. Mr. Evis, the chief clerk and accountant, has been in our service for close upon forty years, and has held his present post for twenty years. Always efficient, always ready, he has proved himself to be a valuable official, and in the whole course of my acquaintance with him I have never known him to make a difficulty. Anything that is ordered or suggested is at once done. Of the two clerks in the office, Mr. Reginald Suggate has been in our service for over forty years, and looks as active now as when he joined. Mr. Henry Simpson has been with us for a quarter of a century, and has conducted the important work connected with the lantern slides from the commencement. Inventive and intelligent, he has been most useful as a photographic artist, apart from his clerical work. Mr. Simpson is now engaged in preparing the Antarctic photographs for the two Societies, and for the use of geologists and naturalists.

The next section of the work of the Society is, II. The *maintenance of the library and map-room.* Under a succession of such able librarians as Mr. Rye, Mr. Keltie, Dr. Mill, and Mr. Heawood, during the last thirty years, the library has steadily advanced both in the number and value of the books and in their arrangement. I believe now that it is the largest and best geographical library in the world. I remember that I began the first catalogue with the help of a boy named Tattersall in 1862, and it was completed by Mr. Purrier in 1866. Now there is a complete authors catalogue kept up to date, as well as an elaborate subjects catalogue. So that, if any Fellow of the Society wishes to study a particular region, the whole of its literature can be placed before him in a few minutes. The Society is well served by Mr. Heawood, a librarian who carefully trained himself to the work, and who is also an accomplished geographer, a man of literary attainments, and a most obliging helper to all who seek information from him. His assistant, Mr. Vincent Hawkins, has been with us for over thirty years, and has an intimate knowledge of our library; and two young lads, Arthur Jones and Woodrow, while working hard and diligently, are being trained to be future librarians.

In connection with the library I must mention the Hakluyt Society, for the editing of old voyages and travels which would otherwise be inaccessible. A thorough geographer, such as Lord Curzon of Kedleston, when about to explore a selected tract of country, makes himself acquainted with all that has previously been done in the same region; so that the study of volumes issued by the Hakluyt Society becomes a necessity to him. Hence the work of the two Societies is very closely

connected. Two of your Presidents, Sir Roderick Murchison and myself, have been Presidents of both Societies at the same time, and our aim was to create an interest among the Fellows of this Society in the labours of the Hakluyt Society. These efforts have lately been attended by a good measure of success, thanks to our very able secretary, Mr. Basil Soulsby.

The map-room, with its great collection of maps and photographs, has been much used during the past year. Under the superintendence of Mr. Reeves the work is admirably organized, while his assistant, Mr. Allen, attends to visitors, conducts the routine work, and meets every emergency with intelligence and efficiency. The number of visitors to the map-room during the year has been 3593, of whom 91 came specially to consult the Ordnance Survey maps. The younger assistant, Mr. Graham Mackay, zealously occupies his time in performing his map-room duties, and in qualifying himself to be a draughtsman. He prepared the maps for my translation of the voyages of Quiros, and did the work entirely to my satisfaction.

The arrangements for the execution of maps for various purposes connected with the work of the Society, under the superintendence of Mr. Reeves, are excellent. Our three draughtsmen, Mr. Addison, Mr. Batchelor, and Mr. Milne, of different degrees of merit, are all well trained and efficient.

I can conscientiously congratulate the Society on possessing an excellent permanent staff in all respects.

III. *The third section* of the Society's work relates to the *training of travellers*. It will be remembered that my resolution on January 27, 1880, establishing the system of instruction for travellers, led to the employment of Mr. Coles as instructor, to the construction of an observatory on the roof, and in 1886 to the addition of geology, botany, and photography to our course, which had previously been confined to practical astronomy and surveying. In 1897 my original scheme was adopted in its entirety, by the resolution to grant diplomas, and by the appointment of an examining committee. Since the retirement of Mr. Coles, his very able and accomplished successor, Mr. Reeves, has continued the work with increasing success. I hear on all sides of Mr. Reeve's ability as an instructor. Many pupils are unable to devote the full time required for a diploma, but all receive useful instruction, and the list of diploma recipients is a goodly list. In my opinion, the plan for the instruction of travellers is the most valuable work that is done by the Society. During the past year sixty-two pupils have received instruction from Mr. Reeves, and nine have obtained the Society's diploma.

In this place comes the geographical instruction given to the two training ships *Worcester* and *Conway*, because it is also under the superintendence of Mr. Reeves, who prepares the questions for the

examinations, looks over the papers, and decides upon the recipients of the three prizes for each ship. I have paid very close attention to these examinations, and to their influence on the cadets, and I have no hesitation in saying that the results are increasingly satisfactory.

IV. The *fourth section* of the Society's work has reference to *assistance to travellers and to research*. For many years the Council has lent instruments and granted funds to travellers, and we have continued to do so; but our power to assist in this respect has been temporarily checked by the great sacrifices the Council has very properly made for the Antarctic Expedition.

In my address last year I explained that we had organized a Research Department as a development of the plan of considering scientific or technical papers at afternoon meetings, which was commenced in November, 1894. These afternoon meetings had been successful, and twenty-three good papers had been read and discussed from 1894 to 1903. They have been continued by the Research Department, but it was also thought that geographical research should be organized.

I have made several suggestions for this end, but none has been taken up. One proposal was the examination of the coast of Holderness and the Humber, and historical researches with a view to ascertaining the changes that have taken place on the coast and in the river since Roman times. Last October I read a paper to the East Riding Antiquarian Society at Hull, on the connection between archæology and geography. I visited the warping near Saltmarsh with Colonel Saltmarsh. I found that there were numbers of local antiquaries, geologists, and marine surveyors ready to communicate their information. A bibliography has also been made. But here the matter stops. There is no one to take up all these threads and prepare a complete memoir. Here I foresee a difficulty in the progress of the Research Department, namely, the difficulty of finding trained men to undertake work. As geographical education progresses this difficulty may become less, but at present it appears to me to be formidable.

The Research Department has also given attention to the best methods of bringing out physical features on maps of various scales, receiving assistance from Colonel Johnston, the Director of the Ordnance Survey. But there is a continual advance in map delineation, and it would not be possible to establish a standard. Our cartographers watch and adopt improvements, or design them. The recent publications of Mr. Bartholomew attest his care and vigilance in producing his maps with all the newest improvements, combining accuracy with beauty of execution. Such work can only be brought out after years of careful study and much research, and the results are highly creditable to our country. It is on such lines that all our cartographers should work. But the school of map-makers is now a small one. We used to have as many as three cartographers on our Council. Now

there are only a few in this country besides Mr. Bartholomew, namely, Mr. Ravenstein, Mr. Bolton of Mr. Stanford's firm, Mr. Darbishire, Mr George Philip, and the younger Mr. Stanford at Oxford who has obtained the Oxford diploma.

Our allied societies of Edinburgh, Manchester, Liverpool, Tyneside, and Southampton have been established within the last twenty years. I delivered addresses, at the opening of their sessions in 1893, to the societies of Manchester, Liverpool, and Tyneside; and I delivered the opening address at the founding of the Southampton Society on November 16, 1897. Last year I had the pleasure of visiting the Scottish Geographical Society.

It seems very desirable that the British societies should work together with common aims, and there have been several meetings of delegates from all the societies to discuss the matter, but without results which can be considered satisfactory. Some have had dreams of an imperial central society with several closely affiliated branches, and one monthly publication in common. Other plans have been suggested. I think that this problem might usefully engage careful attention in the future, and that there might well be a satisfactory outcome of mature deliberations.

V. The *promotion of geographical education* is the *fifth section* of the Society's work. The principle I have always adhered to is, that it would certainly lead to a waste of money if aid was granted without any control over the way in which such grants were administered. My contention has been that a complete system of geographical instruction might be established with help from this Society, if a share of the control was retained by the Council. In consequence of a proposal of this kind, I was invited by Sir William Anson, the Vice-Chancellor, to meet a committee at Oxford, and on February 2, 1899, it was agreed that a sum of £800 a year should be provided, half by the University and half by the Society, to establish an Oxford School of Geography. There were to be three representatives of our Society on the committee. The University was to grant a diploma, and there was to be a scholarship of £60 a year. The old Ashmolean Museum was set aside for the school of geography, consisting of a lecture-room, a library and map-room for study, and an instrument-room. The resignation of Mr. Mackinder, which has just been announced, will necessitate a new arrangement, not yet complete. I remember being much struck by the great ability and insight shown in Mr. Mackinder's paper, entitled "The Objects and Scope of Geography," when it was referred to me on November 28, 1886. Since then he has won a name as a leading geographer. He has been eighteen years Reader in geography at Oxford, and has conducted the school of geography. He has served the University and our Society right well, and his lectures have been crowded. I wish him success in his new sphere of usefulness to

geography at the London School of Economics, and at the London University.

I announced the arrangements that had been made at Cambridge for the establishment of a school of geography, with the help of our Council, in my last address. A board of geographical studies has been formed, on which there are three representatives of our Council, and another member who is on the Council, though representing the University. During the last year there have been several meetings of the Board, and there was evidence that the representatives of the University are seriously determined to make the teaching of geography a success. Lecturers have been appointed for the various branches of the subject.

There has recently been a correspondence in the *Times* on the subject of geographical education, which had the effect of showing us who were our friends, and who were lukewarm or inimical. We now have the Universities of Oxford and Cambridge actively on our side. There is a Board of Geographical Studies in the University of London, on which the Society is well represented; and the subject has been accorded a substantial place in the University examinations. The University of Edinburgh also contemplates the creation of a chair of geography, and our Council has subscribed towards the endowment. We have the War Office with us, which is a most important point; and the best military opinion, represented by the director of the Staff College, the son of our revered President, Sir Henry Rawlinson, is strongly in favour of the teaching of geography.

Progress is slow but sure. The other Government Departments will follow the lead of the War Office. The Universities will continue their work so well begun, and will eventually turn out properly trained teachers of geography in sufficient numbers. Then the schools will be obliged to give geography its proper place in their scheme of studies; and finally, the Civil Service Commissioners must succumb. I believe that the hardest and most difficult period of our advocacy is nearly past, and that continuous, steady pressure in the right directions will, before very long, have the effect of securing satisfactory results.

VI. Twelve years ago I pointed out that it was a fallacy to suppose that *the work of discovery* was nearly completed, and that there are no unknown regions, except the polar regions, to explore. It was a fallacy then, and, although much has been done since, it is still a fallacy. There are wide tracts, in all the great divisions of the Earth, which are unknown to us, and which will furnish work to explorers for many years to come. Moreover, there are regions of vast extent which are only very partially known to us, the more detailed examination of which will enable explorers to collect geographical information of the highest value and of the greatest interest. Our motto must still be "Ob terras reclusas."

In the address which I had the honour of delivering to my associates

in November, 1893, I entered, in some detail, into an enumeration of the parts of the Asiatic continent which were then unknown and in need of exploration. During the twelve years that have since elapsed, many gallant explorers and surveyors have reduced the unknown areas considerably, and supplied us with much valuable information. In Asia Minor, where the Society has given so much help to explorers, we have since had papers on the headwaters of the Euphrates by Mr. York, on the cañons of the Euphrates by Mr. Huntington, on Caria by Mr. Myres, and an excellent memoir on the Cilician Gates and on the orography of the region by Prof. Ramsay, while Colonel Maunsell has contributed a valuable map, and Colonel Massy is about to give us the results of his recent work. In Arabia, Mr. Bent has given us the results of his journeys in Hadramaut and Oman.

Advances have also been made in our knowledge of Kurdistan and Persia. Colonel Maunsell gave us a most interesting paper on the mountainous region round the headwaters of the Bohtan and great Zab, tributaries of the Tigris; and Earl Percy has also traversed the Van region and the country of the Kurds. In Persia, Colonel Sawyer made us acquainted with Khuzistan; and Major Sykes with Kerman, Yezd, Bunder Abbas, and Seistan. We were impressed with the valuable work that is being done by Major Sykes in that region. Lord Rolandshay also brought to our notice an important route which he traversed in eastern Persia.

In the Afghan region we have had an important paper by Major McMahon on the southern border of Afghanistan, and others by Sir F. Younghusband on Chitral, and by Sir George Robertson on Kafiristan. Sir Thomas Holdich largely increased our information by his account of Tirah and the Afridis, and his paper on the geography of the north-west frontier of India. Sir Thomas has also pointed out, in another very interesting paper, the use of geography in the delimitation of frontiers.

The first geographical work of importance in Central Asia, during my presidency, was the settlement of the questions relating to the source of the Oxus by our Gold Medallist, Lord Curzon, the present Viceroy of India. Lord Curzon is one of those travellers who make themselves intimately acquainted with all that has been done before in the region they select for exploration. In this way alone can geographical work be done with any thoroughness. Dr. Sven Hedin has worked in the same way, and his labours have been considered to be of such exceptional value that our Council has awarded him the Victoria Medal for research, as well as the Royal Medal as a distinguished traveller.

Preceding and following Sven Hedin, our own travellers, Littledale, Wellby, and Deasy, all trained observers, have added largely to our knowledge of Central Asia, including the northern part of Tibet;

and we have received an excellent description of Bokhara from Mr. Rickmers.

Dr. Stein's journey to the region of Khotan, where he examined some of the abandoned cities, was of special interest and value, because he combined the qualifications of a linguist and archæologist with those of a surveyor.

By far the most important additions to our knowledge of Asiatic geography have been made in Tibet. This is a subject to which I have given close attention for many years. In the introduction to my work on missions to Tibet, I gave a detailed account of our political and geographical intercourse with Tibet, including the journeys of the pundits. It is pleasant to hear from Sir Francis Younghusband and Major Ryder that the work of these native explorers, undertaken under extraordinary difficulties, is remarkably accurate. Great credit is due to them, and also to General Walker and Colonel Montgomerie, who instructed and despatched them. In my book I made it clear that Warren Hastings had established most friendly relations with the lamas 130 years ago, and that if his wise policy had been made continuous that friendly intercourse would have been firmly established. There would have been a flourishing trade, and the lamas and governing classes would now be as friendly and enlightened as they were in the time of Warren Hastings. Their recent obstruction and present ignorance are solely due to their isolation. The people of Tibet have always been friendly, and the reception of Captain Rawling and Major Ryder, during their long journey, showed that the lamas are now also friendly. But I have not before mentioned the projected mission to Tibet of Mr. Colman Macaulay, which was abandoned in 1886. He had worked long to prepare for the mission, with energy and intelligence, and had visited Peking to pave the way. All was ready, when the Government of India suddenly abandoned the mission—a most unaccountable proceeding. Macaulay wrote, "Everything had gone so fairly that it was difficult to believe that we should be shipwrecked within sight of the promised land. However, we may still hope that something will be done, and that China will be kept to her promise to take measures to promote trade between India and Tibet." Vain hope! Poor Macaulay died, and the policy of drift was resumed. The unwise abandonment of Macaulay's mission was a calamity both for India and for Tibet.

It was due to the administrative wisdom of Lord Curzon that a mission to Tibet was at length organized on an adequate scale, and that our gold medallist, Colonel Sir Francis Younghusband, was appointed to conduct it. No better man could have been selected as the successor of Colman Macaulay, under a Viceroy who does not abandon what he undertakes. Younghusband had already won great distinction as a geographical explorer. He combines firmness and resolution with a

conciliatory spirit when the time comes for it, so that he first beat down the opposition of the lamas, and then won their hearts. If the policy of Warren Hastings had been followed from the first, there would never have been any opposition. Trading stations have now been established at Gyantse and Gartok, which is a most important step in advance. But other excellent measures, such as the acquisition of the Chumbi valley for a long term of years, and the exploration of the Dihong gorge and of the Tengri-nor, were, unfortunately, prevented by military exigences and official prudence. Nevertheless geography has been a considerable gainer. Sir Francis Younghusband's mission, accompanied by two such surveyors as Major Ryder and Captain Cowie, has resulted in a survey of the Chumbi valley and of the whole route from Phari to the city of Lhasa, as well as a detailed plan of that city. Moreover, a party was detached by Sir Francis Younghusband, under Captain Rawling, with Captain Ryder as surveyor, to ascend the valley of Tsanpu from Gyantse to Gartok. Altogether, the triangulation of an area of 45,000 square miles has been completed, connecting Lhasa with India, all prominent peaks being fixed with their heights. An area of 17,000 miles was surveyed on a scale of 4 miles to the inch, route surveys of the road to Lhasa were made, and large-scale plans of Gyantse and Lhasa. On the march from Gyantse to Gartok, 40,000 square miles were surveyed, including the Tsang-po from Shigatse to its source, the Mansarowa lake region, and the Gartok branch of the Indus. For all this the chief credit is due to our Gold Medallist, Major Ryder. In my address for 1896, I drew special attention to the regions traversed by these officers, and to the importance of exploring the Tibetan continuation of the Karakorum range, which commences at the central peak of Kailas or Gangri, 21,800 feet above the sea. Mr. Brian Hodgson calls this Tibetan range Nyenchen-tangla. It rises from the northern bank of the Tsanpu, and Major Ryder has measured some of its peaks. He has much to tell us about this northern Himalayan range.

We have published, in our April number, an account of the excellent geographical work in Western Tibet done by Captain Rawling and Lieut. Hargreaves, to which I alluded in my address last year. The object of the expedition planned by these officers was the extension of Captain Deasy's survey made in 1896. They traversed a wild mountainous region with numerous lakes, and succeeded in surveying 35,000 square miles of previously unknown country—an exceedingly creditable achievement.

The results of the Tibet mission are of immense importance, both to that country and to India, from a commercial and a political point of view, and might have been still more important. To geography our gain has been very great, especially from the first regular survey of the upper Tsanpu valley.

Turning to the further East, we have had three valuable papers on Siam by Mr. Warington Smyth, another by Mr. J. S. Black, and a map, from careful surveys, by Mr. McCarthy. General Woodthorpe and Mr. Carey have given us information respecting the Shan States, Mr. Hugh Clifford on the States of Kelantan and Trengganu, and Prince Henri d'Orleans related to us the events of his adventurous journey from China to Assam.

In China some exceptionally valuable work has been done. The survey of Yunnan by Captain Davies, accompanied by Major, then Captain Ryder, will probably lead to the further development of that extensive province. The very interesting expeditions of Colonel Manifold in Central and Western China seem to supplement the work of Captain Davies; while, in describing the country round the headwaters of the Yang-tsze and its tributaries, they open up completely new ground. It is likely that the work of both Captain Davies and Colonel Manifold will lead to important results. Further north the results of many years' travel and survey in Manchuria by Mr. Turley should be mentioned, and Mr. C. W. Campbell's interesting journey through Mongolia.

Thus an immense advance has been made in our knowledge of the geography of Asia during the twelve years of my presidency, but much remains to be done. A vast area of Arabia is still unknown. The northern side of the Nyen-chen-tang-la remains to be explored and studied. No one has yet penetrated the Dihong gorge. There is a complicated area of mountain ranges and streams round the sources of the Burmese rivers which is entirely unknown. Many other parts of Asia are very incompletely surveyed and mapped, and need further study. There is still much, very much, for explorers to undertake on the Asiatic continent, and here assuredly it cannot truthfully be said that there are no longer unknown lands to discover.

My memories of African discovery go back to the time when the Dark Continent was nearly a blank. I knew Dr. Baikie of Niger fame. I remember Burton coming home with a wound in his mouth, got when poor Stroyan was killed. Speke came to me to discuss his plans before he went out with Burton. I was at the festival to Livingstone, and was much with him before he started on his last journey. But these are distant reminiscences. When I became President in 1893, I mentioned three regions in Africa that were unexplored, forty years having wrought a wonderful change. There was the Sahara and other parts of the French territory, there was Wadai and parts of the Lake Chad region, and there was the country south of Abyssinia and from Somaliland to the Sobat and the Nile.

As regards the Sahara, M. Foureau was even then engaged on his remarkable expeditions, not only penetrating further than any predecessor, but fixing his positions scientifically. For opening routes to the Chad region, geography is indebted to the energy and the

administrative skill of Sir George Goldie in establishing order over the region of northern Nigeria, through which the routes pass to the eastward. We have had papers by Mr. Wallace, Sir Frederick Lugard, Colonel Vandeleur, and Major Burdon on northern Nigeria, and most valuable geographical information from Colonel Elliot, who was on the Anglo-French, and Colonel Jackson on the Anglo-German, boundary commissions. Our French colleague, Captain Lenfant, has, however, done the most important work in the Lake Chad region; while other French officers have done much new work to the west of the lake, and on the upper and middle Niger and the great bend of that river.

Colonel Trotter, in the course of his labours in the delimitation of the Sierra Leone boundary, collected much geographical information, especially on the source of the Niger, which he communicated to the Society.

Turning to the eastern side of Africa, the Ruwenzori country has been explored and described by Mr. Scott Elliot, Sir Harry Johnston, and Mr. Moore, and in part by Mr. Grogan in his journey from the Cape to Cairo. There have been two ascents of Mount Kenia: the first was by Dr. Gregory; the second I may describe as a model journey by Mr. Mackinder.

Uganda and British East Africa are becoming well known. After Sir Frederick Lugard, our lamented friend Colonel Vandeleur was one of the first to describe the country to us; and it has since been brought to our notice in more detail by Mr. Buckley, Captain Crawshay, Major Pringle, Mr. Hobley, Colonel Delmé-Radcliffe, Colonel Smith, Sir Harry Johnston, and Mr. Fisher; while the northern division has been described by Colonel Sir J. R. Macdonald and Major Powell Cotton.

Mr. Moore undertook a journey, which was full of interest, to Lake Tanganyika; and we have had papers on the Congo division by Mr. Grenfell, Mr. Hinde, and on the old kingdom of Congo by Mr. Lewis. Our most promising African traveller, and the one who has done the greatest amount of good work, is Major Gibbons, in his exploration of the Barotse country, and his journeys northward to Egypt.

The unknown country which I considered the most important in Africa when I addressed the Society in 1893, and which I still look upon as the most interesting, is the region south of Godjam and along the southern boundary of Abyssinia to Lake Rudolf, and from Somaliland to the Sobat and the Nile. Dr. Donaldson Smith, in his first journey, explored the Lake Rudolf region, and in his second admirably managed expedition he reached the Nile. Mr. Cavendish explored the shores of Lake Rudolf; and Major Austin, in his two very important expeditions, completed our knowledge of the country between the lake and the Nile, while Mr. Jessen has recently filled up important lacunæ.

The staff of surveyors under Colonel Talbot has executed a large amount of mapping in the Sudan, while Sir William Garstin and Major Lyons have contributed to our knowledge of the regions of the Nile. Other names connected with the exploration of Abyssinia are those of Mr. Crosby, Lord Lovat, Mr. Weld Blundell, and Mr. James Harrison.

North of Lake Rudolf there are some most interesting tracts of country near the southern frontiers of Abyssinia. A paper was communicated to us by Mr. Neumann, describing the upland countries of Kaffa and Enarea, on the southern slopes of the Abyssinian plateau; but much remains to be done in this the least-known part of Africa. The expedition under the auspices of Mr. Butter has since continued the survey along the southern frontier of Abyssinia, and we have received the results, with a valuable map from Captain Philip Maud.

A great deal of excellent geographical work has been done by the joint commissioners for the settlement of frontiers; by Colonel Leverson on the Anglo-Portuguese delimitation commission; by Captain Boileau on the Nyasa-Tanganyika plateau; by Colonel Elliot and Colonel Jackson in northern Nigeria, Colonel Trotter in Sierra Leone, and Mr. McCarthy in Liberia; and at a recent meeting Colonel Delmé-Radcliffe has given us an account of his work with the Germans to the west of Victoria Nyanza.

In the Lake Nyasa region, and the country between that lake and Tanganyika, much valuable work has been done by Sir Alfred Sharp, Mr. Codrington, Mr. Wallis, Mr. Beringer, and others, while Mr. Poulett Weatherley has added largely to our knowledge of Lake Bangweolo and the region to the westward.

Mr. Harris gave us a very interesting narrative of his journey across one pass of the Atlas, and of his visit to the oasis of Tafilet. But a great part of the Atlas mountains are still unexplored; nor should we forget the journey of our lamented friend Bent on the Red sea littoral, where also much remains to be done. Captain Crawshay's valuable contribution to our knowledge of Basutoland should be mentioned, and there are many other important journeys which have helped to fill up the blanks which disfigured our maps of Africa twelve years ago, but to which I have not space to refer in detail.

The progress of exploration in Africa during the last twelve years has certainly been very striking, and a large share of the credit belongs to our French associates, with whom our geographical rivalry has always been of a most friendly character. We shall next hear of them in Wadai. But whether in the Atlas mountains, on the Abyssinian frontiers, along part of the Red sea littoral, or in other regions, there remains much and important geographical work to be achieved in the African continent.

Probably the greatest extent of unknown land is in the New World.

In November, 1893, I quoted Mr. Dawson that 954,000 square miles were undiscovered. Since then there has been progress. Prof. Norman Collie's able researches in the Rocky mountains amount to discovery. Dr. Bell has informed us respecting the region south of Hudson bay, and young Mr. J. M. Bell sent us an interesting account of his work north of the Great Bear lake. Mr. Low's explorations of Labrador and to the south of Hudson bay are of high importance, while Mr. Hanbury and Mr. Tyrrell have traversed great stretches of barren lands of northern Canada. The most remarkable communication from North America has been Dr. Bell's account of his voyage along the south coast of Baffin island, and of the great inland lakes. It is so interesting because it shadows forth the geographical importance that attaches to further discoveries in this direction. I trust that they will eventually be undertaken by the Dominion Government, which has already done so much through the agency of its geological and topographical surveyors.

Respecting Mexico, we have had papers on the Sierra Madre and on Popocatepetl by Mr. Howorth, and a very excellent paper on the tribes of the Sierra Madre by Dr. Lumholtz.

There is no higher authority on South America than our Vice-President, Colonel Church, and in 1901 he gave us a most suggestive paper on South American geography. There are vast unknown areas, especially on the eastern side of Colombia, and any explorer would be sure to receive assistance from our Honorary Corresponding Member, General Don Rafael Reyes, the President of that Republic.

It is much to be desired that the whole structure of the Andes should receive systematic examination by young explorers sent out by the Research Department, who have won our diploma. We might divide the Andes, for this purpose, into four divisions. The first would be from the frontier of Ecuador (where the Andean peaks and ridges have been well examined by Humboldt, Wulf, and Whymper) to the knot of Cerro Pasco. Here are the great rivers Marañon and Huallaga. The work in each division should extend from the shores of the Pacific, across all the mountain ranges, to the banks of the first great river in the *montaña*. Mr Enock, a young mining engineer, has given us a lucid and fascinating description of one of the most remarkable features of this division of the Andes, namely, the lateral valley of Huaylas, with its bordering mountains, and an account of an ascent of one of the snowy peaks.

The next division extends from the knot of Cerro Pasco to the knot of Vilcañota, a region drained by the Apurimac and Vilcamayu, affluents of the Ucayali. The centre of interest in this division is the city of Cuzco, and much good work has been done in the *montaña* to the eastward, quite recently, by Villalta and other Peruvian explorers. The maritime cordillera, in this division, has never been systematically described to

us; and the provinces of Parinacochas with its lake, of Lucanas, Cangallo, Aymaraes, and Cotabamba await examination by a competent geographer.

The basin of Titicaca would be the third division, and it is perhaps better known than the others. D'Orbigny and Forbes, Castelnau and Wiener, Minchin and Crequi-Montfort have studied the country and people. There are steamers on Lake Titicaca, but the more northern lake of Arapa is unexplored.* Our Gold Medallist Sir Martin Conway has done admirable mountaineering and surveying work on the mountains of Illimani and Illampu, but many peaks on this part of the maritime cordillera are unmeasured. Great credit is due to the Bolivians themselves for their recent exploring expeditions on the tributaries of the Beni, encouraged by our colleague Colonel Ballivian, and under the auspices and leadership of the late President of the Republic, Colonel Pando.

The fourth division would extend from the southern extremity of the Titicaca basin to the Andes of Chile. This includes a very wild mountainous region where the separate cordilleras unite into one. The Santa Catalina sierra, so graphically described to us by Mr. O'Driscoll a year ago, forms part of this division.

The Chilian Andes are much better known. Aconcagua, the highest mountain in South America that has been measured, has been ascended by one of Fitzgerald's party and by Sir Martin Conway. But further south, especially on the eastern side of the Patagonian Andes, I pointed out in my address of November, 1893, that we had a good deal to learn. Steffen afterwards gave us a paper on the Pacific side of the mountains, we had reports from Ramon Lista on the east side, and later our learned colleague, Don Francisco Moreno, gave us much information respecting the newly discovered lakes at the base of the Patagonian Andes.

It was the appointment of our Vice-President, Sir Thomas Holdich, on the arbitration commission, which led to our obtaining a more complete insight into the true character of this most interesting mountain system.

I first had the pleasure of making the acquaintance of Sir Thomas Holdich on the banks of Lake Ashangi, in Abyssinia, on April 28, 1868. He was then commencing a very distinguished career. Holdich has carried on surveys in the midst of warlike operations, and has conducted, with skill and success, the work of frontier delimitation on the Pamir. No one could have been selected who was so well fitted for the very responsible and laborious duty of settling the boundary between Chile and Argentina. He was quite new to the country and to the people, yet he acquired the confidence of both sides in the dispute. Through the papers he communicated to us, and through his book, we now have a fair knowledge of a very remarkable region, of special

* 'Castelman,' 3, ch. xxxix. p. 420.

geographical interest, which, in November, 1893, when I delivered my first address, was only very partially known.

The expedition of Dr. Nordenskiöld in the South Shetland islands and along the north-west coast of Graham Land, has resulted in the exceedingly important discovery of a fossil flora belonging to two geological periods, the Jurassic and the Tertiary. The discovery points to the existence of coasts covered with the vegetation of a temperate climate, at a distance of about 400 miles south of Cape Horn. One cannot help speculating on the outcome of such a discovery, though at present it is perhaps rash and premature to do so. But here appears to have been the continuation of the Andes, and the connection between South America and the Antarctic continental lands, at a time when the climate was mild, and vegetable and animal life were abundant.

Much has been done for the further exploration of Australia during my presidency, and also in Polynesia. But I only have space to refer to the important journey of Mr. Carnegie in West Australia, and to Prof. Gregory's investigation of the geography of the Lake Eyre region. In New Zealand we have derived much information from Mr. Fitzgerald's work in the Alpine region, and from the careful study of the lake country by Mr. Lucas. The appointment of my young friend, Mr. Mackintosh Bell, to the directorship of the Geological Survey in New Zealand is sure to lead to the best results.

The Society had done much towards the exploration of the Arctic Regions during the earlier years of its existence, while the despatch of the Arctic Expedition of 1875 was entirely due to its exertions. Our great object was to send an expedition up Smith sound, and explore the north coasts of Greenland and Ellesmere island. General scientific results, and the exploration of the unknown region, and not a sledging attempt to reach the pole, should have been, in our view, the main objects of the expedition. But the Admiralty announced that to reach the pole was to be the main feature. Nevertheless, excellent work was done by sledging parties to the east and west of the northern opening of Smith sound, for a distance of 300 miles. A study of the tides proved the insularity of Greenland, but the great result of the expedition of 1875 was that it enabled us to connect all former work, and to see the existence of a tremendous line of ice-pressure from near Cape Barrow to the east coast of Greenland. The great Arctic ocean presses its ice-covered waters against its western side, where the sole opening of escape is along the Greenland east coast.

Combining this with all that had been observed in other parts of the Arctic Regions, I was able to arrive at some general conclusions. I embodied these conclusions in my report on the Arctic Expedition of 1875–76, which was printed in our *Proceedings*,* now twenty-eight years ago.

* Vol. 21, No. vi. p. 536 (Old Series), September, 1877.

I then pointed out that the next most interesting object of future research would be to ascertain the extent of the polar ocean, the western limit of which was represented by the heavy ice-pressure on the American side. I maintained that Franz Josef Land was part of the Spitsbergen group on the same comparatively shallow plateau, and that there was a deeper ocean to the north. I also maintained that the warm current, aided by the discharged volumes of water from the Siberian rivers, caused a movement round the polar area from left to right, and also across from the eastern to the western hemisphere. My deduction was that, by the sea north of Siberia, important discoveries would reward the future explorer who boldly advanced northward on this line. He would be in the rear of the ice-laden polar sea discovered by the expedition of 1875, and would thus complete the solution of the questions in physical geography connected with it.

This was just the view taken, many years afterwards, by Nansen, after having carefully studied the Arctic questions. He arrived at his conclusions quite independently, never having seen my report, and his plan was absolutely original. When he did read my report after his return, he gave prominence to the coincidences, in the most friendly manner, in the preface to the Norwegian edition of his work.

Unfortunately, I was abroad when Nansen came to England to explain his scheme, and I lost the opportunity of defending it against the adverse and erroneous criticisms with which it was met. But it was a great pleasure to me to preside at the Albert Hall on February 8, 1897, when Nansen received a right English welcome on his triumphant return from his great achievements. For Nansen had drawn back the veil which had concealed the Arctic mystery. We now know that the Arctic Regions consist of a deep polar ocean nearly surrounded by land, with a flow of Atlantic water inwards on the Siberian side, and outwards down the east coast of Greenland.

There ceased to be any geographical object in reaching the north pole if it is in a deep ocean, except for the sake of deep-sea soundings. Our Council, in all its records, has discarded the attainment of the highest possible northern latitude and the attempt to reach the pole as useful objects, by themselves. To reach the north pole would be a sporting thing to do. It is quite feasible, but it is not likely to prove of any geographical interest.

There were still several very important pieces of geographical work that remained to be achieved in the Arctic Regions after the return of Nansen. The first was the rounding of the northern point of Greenland, another was the completion of our knowledge of the Parry group by the Jones sound route, and the third is the discovery of the unknown parts of the east coast of Greenland.

Captain Sverdrup undertook the Jones sound route, and, helped by a very efficient staff, he completed his discoveries during four years.

These discoveries finish the work in that direction, and probably complete our knowledge of the Parry islands. Captain Sverdrup and his geologist, Mr. Skei, gave us an account of these discoveries on April 27, 1903, when he received the Royal Medal.

Our other Gold Medallist, Captain Peary, succeeded in rounding the most northern point of Greenland; and he gave us a very interesting account of his expedition on November 10, 1903.

The east coast of Greenland remains to be explored. The coast from Shannon island, in 75° 12′, to the northern extreme reached by Peary, a distance of nearly 500 miles, is entirely unknown. Yet it is, in some respects, a region of special interest. Here, if anywhere, a knowledge may be obtained of the very interesting migrations of Eskimo and large mammals from east to west. Clavering, in 1822, found twelve Eskimo on the coast between 74° and 75° N. But none have ever been seen since to the north of the settlement of Angmagssillek. Knowledge is also needed of the northern migrations of the musk-ox, reindeer, wolf, and fox. The numerous deep fjords should be explored, and the labours of the German expedition, of Nathorst, and of Amdrup require to be connected and completed.

In Herr L. Mylius Erichsen we have an explorer who is both capable and willing to undertake this great task. He has already been with the Eskimo between Cape York and Cape Alexander for ten months, has sledged across the island of Disco, has visited the inland ice in two places, and knows the whole west coast of Greenland. If he succeeds in raising the funds for the expedition he contemplates to explore the east coast of Greenland, I would wish him all possible success, for I look upon this exploration and discovery of East Greenland as the most important work that remains to be done in the Arctic Regions.

I must not omit to wish God speed to young Amundsen in his very small vessel the *Gjöa*. I had a short cruise with him in the *Gjöa* on October 2, 1902. She is only 60 tons, a little cutter-rigged fishing-boat about the size of the vessels of Hudson or Baffin. His object is a most useful one—to reach the north magnetic pole and take a series of observations extending over a considerable period. It is not impossible that he may make the north-west passage. Such a gallant attempt deserves success, and I hope my friend Amundsen may attain his heart's desire.

We had received the gratifying news of the complete success of our Antarctic Expedition before the last anniversary. Since then we have welcomed our gallant friends, I trust, in a suitable manner worthy of the great occasion. At Portsmouth there was real enthusiasm, and the mayor welcomed the explorers with splendid hospitality. We strove to do the same at the docks and when they arrived in London. Next there was a grand reception in the Albert Hall. A special gold medal was presented to Captain Scott, and silver medals to the officers and

men. I was anxious that justice should be done to their scientific work, and that the Fellows of the Society should be made better acquainted with it. My plan was that the officers charged with the different branches of scientific work should read preliminary papers at afternoon meetings, and that Captain Scott should sum up the general scientific results at an evening meeting. They all consented cheerfully. On February 6 last, Lieut. Royds, R.N., read a paper on the meteorology, and Mr. Ferrar on the geology. On the 20th we had papers by Dr. Wilson, on the geographical distribution of Antarctic seals and birds; from Mr. Hodgson, on the invertebrate biological collections; and from Captain Colbeck, on the Antarctic sea ice. On May 16 Mr. Bernacchi addressed us on the magnetic and other physical observations.

On February 27 Captain Scott read his very important paper on the geographical results of the Antarctic Expedition. But we must wait for full and complete information until the publication of his book next autumn. The scientific results will take a longer time for their preparation. The geology and biology will form two or more volumes, brought out under the auspices of the British Museum, and edited by Prof. Ray Lankester. The meteorology is undertaken by the Meteorological Office in a series of memoirs, two of them by Lieut. Royds, R.N., and Mr. Ferrar. The magnetic and pendulum observations will be worked up at the Kew Observatory. The resulting volumes are to be of uniform size. Arrangements are also being made for the issue of the *South Polar Times* in facsimile, the only serial publication ever produced in the Antarctic Regions. It contains several articles on equipment, on natural history, geology, and magnetic work, which are of great value, besides humorous contributions and records of events, and is most beautifully illustrated. It brings home to us what life in the far south really was, and is an essential part of the history of the expedition.

Lieut. Mulock, R.N., has been working hard, for several months past, at the maps of the Antarctic Expedition, and he hopes to finish the work by next June. But Mulock does what he has to do thoroughly. He has worked over again every sight and every bearing, which takes time. The result will be a map of remarkable accuracy, most artistically drawn and finished, which will be of great value to geographers and geologists.

All has gone well except with the good ship *Discovery*. It was our earnest wish that so valuable a vessel—the only one ever built specially for scientific purposes—should be taken by our Admiralty, and preserved until she was needed for another expedition. We offered her at a price which would only have left us just sufficient funds for the publications. She would have been invaluable for magnetic observations, as she is the only vessel on board which they can be taken. I understand that the American Government is building a vessel specially for that purpose. The *Discovery* would also have been useful for deep-sea soundings, for

surveying, and for other purposes. She is larger than any vessel now used for surveying. But the Admiralty was badly advised, and the refusal must be looked upon, under the circumstances, as a national calamity.

We were thus driven into selling the *Discovery* to the Hudson's Bay Company for £10,000. We have to thank our associate, Mr. David Bruce, who acted as our agent, for the efficient and liberal way in which he conducted our affairs at the docks, and in connection with the sale.

It will be a source of satisfaction to all who are interested in the expedition to know that Mr. W. E. Smith, C.B., our highly valued designer and adviser in building the *Discovery*, has placed the history of her construction on record in the *Transactions* of the Institution of Naval Architects. His paper, "On the Design of the Antarctic Exploring Vessel *Discovery*," was read at the special meeting of the Institution on April 12 last. It is accompanied by appendices on compass deviation, on the machinery, and on the specification, with several plans, and contains suggestions for improvements in the next ship for Antarctic work.

It only remains for me to record our most cordial thanks, and I am sure that all my associates will be in accord with me, to those who have brought this great expedition to a successful termination.

Our thanks are first due to the very liberal subscribers; for I think it a wonderful thing that upwards of £70,000 should have been raised for the two ships, *Discovery* and *Morning*. Above all, we have to thank Mr. Longstaff for his munificent and patriotic donation of £30,000. Such generosity takes us back to the days of Queen Elizabeth, when merchant princes, thoroughly understanding the needs of their country, came forward almost habitually to provide funds for expeditions of discovery. In later times, Sir Felix Booth did the same for the expedition of the Rosses, and was rewarded with a baronetcy. Mr. Longstaff's great service, he may feel assured, has the admiration of his countrymen.

Nor must our New Zealand friends be forgotten. Their kindness and hospitality was unbounded, while their Government generously subscribed £1000 towards the equipment of the *Morning*, when our own Government had refused all help.

Gratitude is also due to my valued colleagues, the members of the Joint Antarctic Finance Committee, and to their secretary, Mr. Cyril Longhurst. They have transacted the whole business of the expedition in this country during five years most harmoniously, and are as good friends now as they were when they began.

Our Council recorded a resolution in recognition of the great services of Captain Scott, his officers and men. I firmly believed that they had all the mental and physical gifts which command success. There are few men who combine so many qualifications as Captain Scott for the

leadership of such an expedition. Those qualifications ensured good results, and, having acquired the full confidence of his officers and men, they were ready to do anything for him and to follow him anywhere. That is the explanation of the extraordinary success of the sledge journeys. The captain was the best man among them, fared exactly as the men did, and worked harder than any of them. His excellent system of organizing and directing the scientific work was no less to be commended than his care for the health and comfort of all under his charge. Every officer and every man was zealous for the interests of the expedition, while perfect harmony and good fellowship reigned throughout the commission. Never did officers and men so worthily win and so fully deserve the thanks and approbation of the great Societies they have served so well.

We have also to thank Captain Colbeck and the officers and men of the *Morning*, who so loyally supported him. A better man than Captain Colbeck for such work could not have been found. His two voyages were conducted with rare ability, and he was ready to give his last bit of coal to the *Discovery*. The Council has endeavoured to mark their sense of the value of his services by the presentation of a piece of plate emblematic of his Antarctic voyages and their object.

I do not now hesitate to declare that my chief object in working for the despatch of the Antarctic Expedition was to give young naval officers and men a chance to distinguish themselves in time of peace. From the days of Nelson there have been no better fighters than Arctic men. Polar service braces them up for the regular work of the navy. Our worthy petty officer, Edgar Evans, was the best sledge traveller next to Captain Scott, and now he is one of the best shots on board the *Narcissus*. There is no more useful service to the country than the encouragement of maritime enterprise, to which England owes her greatness and her colonies.

The next object, in which I was bound to take an interest, was geographical discovery and the advancement of the kindred sciences which are the handmaidens of geography. It is justifiable to look at Captain Scott's discoveries with reference to the still unknown Antarctic area, and to endeavour to form some idea of the unknown part based on our actual knowledge. For the discoveries of Captain Scott's expedition furnish indications which enable us to enlarge our conceptions of the real nature of the whole area, and to give reasons for opinions respecting the parts which are still unknown.

For convenience in describing the several parts of the vast region, it is divided into four quadrants—

I. The Victoria Quadrant, 90° E. to 180° E.
II. The Enderby Quadrant, 90° E. to the meridian of Greenwich.
III. The Ross Quadrant, 180° to 90° W.
IV. The Weddell Quadrant, 90° W. to the meridian of Greenwich.

It is curious that land has been reported on the Antarctic Circle from 170° E. to 97° E., along the curve of the Victoria Quadrant, and also along the curve of the Enderby Quadrant. Some of this land is doubtful, and some that has been reported has since been found to have no existence.

In 179° 55′ E. is the interesting island discovered by Captain Colbeck, and named Scott island. In 163° E. are the five Balleny islands, undoubtedly volcanic. The distance thence to Adelie Land is 430 miles.

On January 16, 1840, Captain Wilkes thought he saw land in 157° 46′ E., and on the 18th in 154° 30′ E., and again on the 22nd. But in February, 1850, the *Brisk*, a ship belonging to the Southern Whaling Company, under the command of Captain Tapsell, started from Auckland island, and sailed as far as 143° E., considerably to the south of Wilkes's track, and there was no land. Again, on March 3, 4, and 5, 1904, Captain Scott, in the *Discovery*, sailed across the meridians from 175° to 154° E., to the south of Wilkes's track, in very clear weather, and saw no land. The soundings gave a depth of 250 fathoms.

From January 19 to 30 Dumont d'Urville, in 1840, saw land from 140° E. to 130° on the Antarctic Circle, but it was only made out at a great distance, with icebergs intervening. A landing was effected on one of eight or ten rocky islets. He then sailed along ice cliffs further north for 60 miles, from 137° to 134° E. The distant land was named *Adelie*, and the ice-cliffs *Côte Clarie*. Wilkes appears to have sighted *Adelie* and *Côte Clarie*, previously discovered by Dumont d'Urville, between January 30 and February 7, 1840.

On March 2 and 3, 1839, Captain Balleny had discovered land in 117° 4′ E., about 70 miles north of the Antarctic Circle. He named it Sabrina Land. Wilkes saw it indistinctly on February 10, 1840.

Captain Wilkes reported appearance of land at a great distance, from 112° to 106° E., and on February 14, 1840, he was only 7 or 8 miles from it. He described it as coast-line extending for 75 miles, and named it Knox Land. On February 17 he reported "appearance of land" trending north, when he was in 97° 37′ E. and 64° N. He named it "Termination Land." There cannot be any certainty about sighting Antarctic land at a distance, unless the complete outline is made out, or black patches of rock are seen on the mountain-sides. Drygalski has since reported that Termination Land does not exist; and Wilkes only reported "appearance of land."

In 1902 Drygalski came upon land in 66° 20′ S., consisting of a conical mountain called Gaussberg, on which a landing was effected, and a line of ice-cliffs, the whole between 89° E. and 94° E., about 120 miles. It was named Wilhelm II. Land.

No land is reported, with any certainty, between Côte Clarie and Sabrina Land, between Sabrina and Knox Land, or between Knox and Wilhelm II. Land.

There are thus four masses of land along the Antarctic Circle between 145° and 89° E., a distance of 1344 miles. Some of these lands are not within the Antarctic regions.

Adelie and Côte Clarie	...	145° E. to 134° E., 264 miles.
Sabrina	...	117° E.
Knox	...	112° E. to 106° E., 144 „
Wilhelm II.		94° E. to 89° E., 120 „

These lands rest on a shallow plateau with soundings of 250 fathoms. There is a theory that they are connected. In that case they would form the north coast of Queen Victoria Land. But there is no evidence. On the contrary, beyond North cape, the most northern point of Victoria Land reached by Ross in 1841, the land was trending *south* of west. In that case Adelie, Sabrina, Knox, and Wilhelm II. are volcanic islands on the edge of the comparatively shallow plateau, from which the north coast of Queen Victoria Land also rises, at a distance of 200 or 300 miles south of Adelie. The point is of slight importance with regard to the main questions at issue. The northern side of the great mass of Queen Victoria Land rises from this plateau, whether there are islands in front of it or not.

There is also land on the Antarctic Circle, on the outer edge of the Enderby Quadrant. Enderby Land, discovered by Biscoe in February and March, 1831, is on the Antarctic Circle in 49° E. A line of ice-cliffs and black patches on distant mountains were reported, ending to the west in a point called Cape Ann. In 1833 land was reported a little further east and named Kemp Land, but we have no account of its discovery, and the longitudes are doubtful. Kemp Land and Enderby Land are probably the same.

The distance from Wilhelm II. to Kemp Land is about 500 miles. It was here that the *Challenger* crossed the Antarctic Circle in 1873. The longitude was 78° 22' E. The *Challenger* narrative informs us that in 66° 35' S. there was a clear horizon, and that there could have been no high land within 60 miles to the south. The absence of icebergs between 70° and 80° E. was so marked that, coupled with their absence on the same meridians in lower latitudes, the conclusion was arrived at that there could be no land for a considerable distance to the south between 70° and 80° E., and that a high latitude could be reached in that direction.

This argument in the *Challenger* narrative is not very conclusive. If it was, it would be an additional reason for thinking that the coast of Queen Victoria Land beyond North cape continues to trend south of west, and does not turn northwards to connect itself with Adelie.

These indications of land along the Antarctic Circle—Adelie, Sabrina, Knox, Wilhelm II., Kemp, and Enderby undoubtedly point to the approximate position of the northern coast of the great continental mass known as Queen Victoria Land. The ice-cliffs reported at Côte

Clarie, Wilhelm II., and Enderby appear to be of the same character as those described by Larsen and Nordenskiöld on the east coast of Graham Land, and by Scott in Lady Newnes bay and at Cape Gauss. They might give rise to the formation of icebergs, but not those of the largest size.

The discovery of the eastern side of Queen Victoria Land by Ross in 1841, and Scott in 1902–03–04, has proved that a mighty range of mountains extends along that coast from Cape North to 83° S., a distance of 750 miles, with peaks rising to 15,200 feet. These mountains cannot be supposed to terminate suddenly at the furthest point seen by Captain Scott in 83° S., where the heights of their peaks were by no means diminishing. They may extend for at least double the distance, which would be 84° S. on the other side of the pole, perhaps even further. Here, then, is the eastern, and on the other side of the pole the western, side of the great continental mass of Queen Victoria Land.

The Victoria chain of mountains consists of primitive rocks, sandstones, and great irruptions of basalt. The sandstone is a formation of great thickness, and contains fossil plants. The strata are approximately horizontal, and there is no evidence that lateral pressure of the Alpine type has affected the region since the sandstone was laid down. Long after the deposit of the sandstone the volcanic streams appear to have forced their way through it and over it, forming basaltic caps. The undisturbed sandstone, capped by basalt, appears to extend from Mount Melbourne in 73° S. to the furthest southern point seen in 84° S.

Everywhere signs were noted of the recession, never of the advance of ice, whether in the glaciers, on the upper ice-field, or along the edge of the barrier. In Greenland icebergs come from discharging glaciers descending from the ice-cap. In the Antarctic lands such glaciers do not originate icebergs.

It was believed that the masses of ice attached to the land in several places were the remains of much more extensive glaciation at some distant time.

Near the coast in 79° S. there are several remarkable volcanic islands, on the largest of which is the still active volcano of Mount Erebus. Beside it is the apparently extinct volcano of Mount Terror, and there are three other volcanic islands, while on the mainland, the lofty peak named Mount Discovery, is another extinct volcano.

The mountain chain supports a vast ice-sheet, extending westward for hundreds of miles, and maintaining a level of nearly 9000 feet. At intervals immense glacial streams flow down openings in the chain, but most of them are now inert or receding.

The marvellous ice-cliffs discovered by Ross in 1841 are receding. They are 30 miles to the south of the latitude in which Ross saw them. This is one source of the great Antarctic icebergs. Resting on the

island now named Ross island, which is formed by Mounts Erebus and Terror, in about 78° S., these ice-cliffs extend eastward for 400 miles. They form the termination of a remarkable ice-sheet, which is known as the Great Ice Barrier. Possibly it may fill up a rift or depression between two land masses. Resting on one side against the bases of the Victorian chain of mountains, it is partly fed by the glaciers descending from the inland ice-cap. The whole mass is believed to be afloat. This was indicated by numerous hypsometrical observations, proving that its surface remained only the thickness of the ice above the sea-level, and by the highest temperature in a crevasse being furthest from the surface, as well as by the appearance of tidal cracks.

Captain Scott discovered a continental mass of mountainous land to the eastward of the barrier, which he named King Edward VII. Land. Its coast trended north of east. The eastern side of the Great Barrier seems to rest on the western face of this newly discovered land. The barrier would thus be fed by the glacial streams from both sides.

The great barrier is perhaps the most extraordinary geographical phenomenon on this earth. The whole of the line of cliffs has been thoroughly examined, heights and soundings having been taken at frequent intervals. Captain Scott has himself explored it for 300 miles to the south, Lieut. Royds for over 150 miles to the south-east. But there was a clear horizon to the south, and its history is still a mystery. The most remarkable thing connected with it is that moist southerly winds blow over it with great force, with heavy falls of snow, raising the temperature several degrees, at the *Discovery's* winter quarters.

One theory, with respect to the Great Barrier, is that it merely fills a gulf of vast extent surrounded by mountains. This theory requires that the Victorian mountains should turn to the eastward, and curve round to unite with the mountains of King Edward VII. Land. But there is no indication that the mountains turn in that direction.

Another theory is that the Victorian mountains trend to the east and unite with Graham Land. The trend of the mountains, as far as could be seen, was S. by E. $\frac{1}{2}$ E., which is in the direction of Graham Land. But it is not known whether Graham Land is an island or a long promontory. Nevertheless, this theory is very fascinating, and may possibly be the solution. It seems to connect the Andes, across the south pole, with the mountains of New Zealand. The Graham Land theory is favoured by Captain Scott, and is in agreement with the suggestions of Suess.

But no theory is quite satisfactory which does not include an attempt to explain the southerly winds causing a rise of the thermometer, and the south winds reported at the *Discovery's* winter quarters must be föhn winds, if either of these theories is correct. The barrier may

have light thrown upon its history by the ascertained character of these south winds.

The föhn winds of the Alps and of the west coast of Greenland are dry winds, because they come from over mountains. A moist wind would come from a distant sea. On the west coast of Greenland the föhn winds are south-east winds coming from the Atlantic, where the Gulf Stream preserves a winter sea-temperature of 41° Fahr. Coming from the warmest part of the North Atlantic, and having the shortest distance to pass over the lofty ice-deserts of the interior of Greenland, the föhn increases its temperature in descending to the west, and comes down to Upernavik with a temperature of 42° to 50° Fahr. This föhn wind starts from the Atlantic at 41° Fahr., crosses 400 miles of Greenland ice-cap at heights of 6000 to 7000 feet, and then descends to the west coast. An Alpine föhn is calculated to lose $\frac{1}{2}$° Fahr. for every 180 feet that it rises on the south side of the Alps, and to gain $\frac{1}{2}$° Fahr. for every 180 feet that it falls on the north side, where it descends as a warm and dry wind.

The warm and snow-laden winds from the south experienced at the winter quarters of the *Discovery* are not, therefore, analogous to the Alpine or Greenland *dry* föhn winds. They are reported to be damp, laden with snow, and, if this is so, they have not passed over mountains. They were oftener from the south-west than from the south, but this is accounted for by deflection caused by the coast-line. Winds from the lofty inland ice-cap to the west come over in an upper current, as was shown by the direction of smoke from Mount Erebus, and do not descend to the surface.

We must, therefore, seek for the cause of the high temperature of these southerly winds from some other cause, and not from the winds being föhn winds. The north winds, which were very rare, were comparatively warm, because they came from the ocean to the north. The south winds may be warm from the same cause. They may blow from the ocean beyond the pole—that is, from the Weddell sea. The Great Barrier may, therefore, end on the other side of the pole with another line of ice-cliffs facing the Weddell sea. It fills up a comparatively shallow rift between the Victorian and Edwardian ice-masses, whose ice-fields continually feed it through their glacial openings. It is also fed by the annual snowfalls. Its length may be 1000 to 1200 miles, possibly more. On the other hand, there may be low land intervening between the ice-barrier and the Weddell sea.

The passage of the winds over that distance of ice-barrier with great velocity would not lower their temperature. The experience of the *Alert* exemplifies this. The föhn wind, with a temperature of 46° Fahr., after descending to the sea-level on the west coast of Danish Greenland on November 25, was at the *Alert's* winter quarters on the 26th, a distance of 1300 miles over ice at sea-level, raising the

temperature several degrees. The Antarctic south winds, starting at a high temperature from an open part of the Weddell sea, would blow along the whole length of the barrier and reach the *Discovery* in twenty-four hours, or less, both warm and snow-laden. These south winds seem to indicate that the other end of the barrier may be an ice-cliff facing the Weddell sea.

But a serious doubt is thrown upon this theory by Mr. Shaw. He suggests that the snow coming with the south winds may be carried along in a surface drift, and remarks that the wind, in intense cold, can hold very little moisture. On the other hand, observers on the spot are confident that heavy falls of snow came with the southerly winds, and they were warm, not cold, winds.

The very extensive flat-topped icebergs of the Antarctic seas are too large to come from land glaciers, or from ice-cliffs resting on land. They must be the product of the 400 miles of ice-cliff terminating the barrier on the side of the Ross sea and on the side of the Weddell sea.

Turning to the Ross Quadrant, we find that the northward trend of King Edward VII. Land points towards the neighbourhood of Captain Cook's farthest in 71° 20′ S. and 106° 54′ W. Captain Colbeck found the bergs and floe-ice coming from the south-east, and he concluded that there must be a coast-line in that direction. Cook, at his farthest south, saw ninety-seven icebergs within the pack, like a ridge of mountains, and he thought that land was behind the ice. In the near neighbourhood is the position assigned by the Russian Expedition of 1819 to Peter island. It was seen only at a very great distance. Onward from Cook's furthest, the line of the northern coast of King Edward VII. Land is indicated by the line of the submarine plateau discovered by the *Belgica* from 75° to 103° W., which is only 270 fathoms below the surface, with an abrupt descent on the north side to 800 fathoms. The north coast of King Edward VII. Land would run parallel to the line of the submarine plateau, and perhaps 100 miles or so to the south. The Edwardian coast would then turn south to join with the side facing the barrier.

The Antarctic area would thus consist of two continental land-masses of unequal size, Queen Victoria Land and King Edward VII. Land, separated by this marvellous barrier; and of two seas extending far to the south, the Ross sea and the Weddell sea.

The Weddell Quadrant appears to embrace a large expanse of ocean. Bruce found a tolerably even depth of 2000 fathoms. Weddell sailed as far south as 74° 15′ on the meridian of 34° 17′ W. without seeing any sign of land to the south.

The Weddell sea is bounded to the west by the eastern coast of Graham Land. This is a long narrow strip of high land commencing in 63° S. and extending across (57° to 65° W.) the Antarctic Circle as far as 69° 30′ S. (the Alexander Land of Bellingshausen). Here Arctowski

reported that it appeared to terminate, but this is still uncertain. Thoroughly Antarctic as regards its climate, Graham island appears to be more connected with the Andes than with the Antarctic system. It is, however, suggested that it is a promontory running north from one of the Antarctic land-masses. It may be so, but there is, at present, no evidence to support the theory, while Arctowski's evidence points to its being an island.

On Graham Land there are examples of ice-masses resting on the coast, and extending for upwards of 60 miles along the land, with a width of 40 or 50 miles. Nordenskiöld came to the conclusion that the ice-mass he examined rests on the land, but in part covers a shallow sea, and that it has been, for the most part, formed *in situ*. He calls it "the great ice-terrace," which is a better name than "ice-foot." The Arctic "ice-foot" is quite different. The Antarctic "ice-terrace" seems to be formed by successive layers of snow, and it partly rests on sea ice. The cliffs facing the sea are of varying height. When they are examined, it will probably be found that the "inland ice" of Drygalski, the ice-cliffs of Enderby Land, Côte Clarie, and cliffs to the west of Cape North, are similar "ice-terraces" peculiar to the Antarctic Regions; as well as the ice-masses of Lady Newnes bay, and the so-called Cape Gauss. Captain Scott considers that the latter formations are remains of more extensive ancient glaciation.

The land reported by Bruce in the Weddell sea, and indicated by his soundings, is much further to the west than was to be expected if it is continental land. It may be a large island.

Guided by our actual knowledge, it seems to me that the next Antarctic Expedition should work its way down the western coast of Graham Land, in the track of Larsen, and solve the question of its insularity. Whether Graham Land is insular or continental, the expedition should then force its way through the pack and seek winter quarters on the opposite side of the pole to MacMurdo sound. From that position a system of sledge travelling may be expected to throw much further light on geographical problems the solutions of which are indicated by the researches of the recent expedition. Sad experience has taught us that the despatch of such an expedition is the work of years. It may take less time when the spread of geographical education has reached to those in whose hands the decision of such matters rests.

Turning from these fascinating Antarctic questions, I ought to refer very briefly to our efforts to give the Fellows the benefit of hearing scientific and general papers occasionally, as well as the usual communications of eminent travellers on particular regions. Prof. Lapworth has favoured us with a paper on Earth-folds, and Prof. Milne on movement of the Earth's crust and on earthquakes. Prof. Gregory gave us a suggestive paper on the plan of the Earth and its causes. From the Prince of Monaco we have had an admirable paper on oceanography, and

Sir John Murray on ranges of ocean temperatures. Sir John Murray's bathymetrical survey of the Scotch lochs deserves special mention. From Dr. Mill we have had the results of his researches, undertaken on behalf of the Society, on the English lakes, and of his special study of a selected area in Sussex. From Mr. Vaughan Cornish we have had communications on the formation of sand-dunes, on the formation of sea-beaches, and on ripple-marks and waves. Such papers are very instructive and suggestive. But the most important general paper that has been communicated to us is contained in Mr. Mackinder's masterly address "On the Geographical Pivot of History."

I think it very desirable that we should continue to invite the communication to us of papers of the above kind.

The time has now come to bid farewell to you as your President. Do not for a moment believe that my love for the Society and its work has waned, nor that my desire to serve the Fellows has become less ardent. This is far from being the case. My time and my best efforts have been yours during the last twelve years; and in passing I may note that during that period nearly 800 Fellows have been added to the Society. In the decade from 1880 to 1900 the addition to our numbers only amounted to 150. But recently I have been constantly prevented by illness from taking the chair at our meetings, and from transacting the ordinary business. I felt, therefore, that, in the interests of the Society, I ought to resign my place to a younger and abler successor. With many shortcomings, I have done my best to serve you well, and I wish to thank all the Fellows for their forbearance and invariable kindness.

THE ANGLO-GERMAN BOUNDARY EXPEDITION IN NIGERIA.*

By Colonel LOUIS JACKSON, R.E.

THE task of the Yola Chad Boundary Commission was to survey and delimit the Anglo-German boundary from Yola to Lake Chad. For this purpose it was necessary to fix the latitude and longitude of Yola, and to carry it up by triangulation to the southern shore of the lake and to Kukawa.

Our work lay in Adamawa and Bornu. Of the latter and its people, although it lies in Nigeria, I think not so much is known in England as of the Fulani. Bornu is the remnant of a great Mohammedan empire, which in the thirteenth century extended across the Sudan from Khartum to Timbuctu. Kukawa, the historic capital near Lake Chad, was a centre of commerce and Mohammedan enlightenment for hundreds of years, until in 1893 it was destroyed by Rabeh. At the

* Read at the Royal Geographical Society, March 13, 1905. Map, p 128.

beginning of the last century, when the Fulani empire arose, the sultanate of Bornu had shrunk to a mere fraction of its former extent. Still, the people, although much degenerated, retained enough of their old military spirit to resist the Fulani invasion, and they kept their country, which extended roughly about 150 miles west and south of Kukawa, and eastward to the Shari river. Thus it happened that when we entered Nigeria we found that the predominant powers of the interior were two great Mohammedan nations, who, though at peace, were not on friendly terms. In 1893, just as we were trying to enter into friendly relations with the Bornu power, it was destroyed by Rabeh, a former follower of Zubeir Pacha, who had wandered and fought his way westward from Egypt. He established himself at Dikoa, and ruled with considerable success for some years, until he came into collision with the French, who sent a force from Fort Lamy on the Shari and destroyed him in his turn. After this a British force went up to occupy the country up to the limit which had been reserved to us by the arrangement with Germany in 1893; and shortly afterwards a German expedition came up from the Kameruns to occupy their country. The result of this was that Bornu was cut in two as Adamawa had been, with this difference—that the greater part of Bornu was British, while most of Adamawa became German. Both the British and German Governments proceeded to restore the old Bornu rulers, and Shehu Garbai, the direct heir to the throne, is now the Sultan of British Bornu, while his cousin, Shehu Sanda, is Sultan of German Bornu.

The Bornu people, like the Fulani, are horsemen, and probably owed their early successes to this. The Berebere, who were the seed of the Bornu nation, came from the north-west, from Barbary.

The origin of the Fulani is also assigned by some to Barbary; others have supposed that they came from Egypt. A reference to the map at p. 247 in Dr. Keltie's 'Partition of Africa' will show how the physical conditions of Africa govern racial movements. It will be observed that a great belt of bush and grass country runs right across Africa, roughly in lat. 5° to 15′ N. Movement to the south is checked by the Central African forest region, and to the north by the Sahara. It was thus natural that a pastoral people driven out from the Nile valley, perhaps, as some one has said, by the pressure of some earlier Mahdi, should have moved along this fertile belt until they found a resting-place; also that the Berebere should have drifted from the desert to a more fertile country. Rabeh's movement along the line of least resistance is also thus explained. It follows, again, that people accustomed to fight on horseback, moving in pasture country suitable for cavalry, would have a great advantage over the original Pagan owners of the soil, who probably had few horses. Thus it happens that throughout the Fulani country you find them paramount wherever

the country is suitable for the movement of horses, while the unsubdued pagans have taken refuge in the hills or in the thick bush. Bornu country is suitable for horses almost throughout.

Comparing the people of the two countries in general terms, it may be said that those of Bornu are cheerful, indolent, fond of good food and clothes, and not very keen about their religion. They like military display, martial music, and waving of spears; but it is doubtful if there is much good fighting stuff among them. They are artistic, and display a good deal of taste in their somewhat gaudy clothes. The Fulani are inclined to be ascetic and fanatical. They wear a good deal of clothing, like other Mohammedans, but are not gaudy, affecting chiefly white, dark blue, or the grey-blue native cloth, with a certain amount of embroidery. They are not so clean as the others. When a Bornu gentleman wears a white gown, it is snow-white, and he looks like a gentleman. The Fulani are often dingy. They do not keep their horses as well as those of Bornu, but they are good horsemen. They will ride hard on rough ground, and are fond of exercises, such as spearing a lime on the ground at the gallop. They fight well against the Pagans, but have not hitherto done well against us, except at Burmi, where their fanaticism was in full swing.

The international position in the Western Sudan at present is as follows: Great Britain is in full occupation of Nigeria and British Bornu. Germany, governing from Duala, on the Kamerun seaboard, controls the Upper Kamerun or Lake Chad territories, with two or three companies posted at Garua, Dikoa, and Kussri. France, to the north of Nigeria, is on the borders of the desert, where the Tuareg problem has to be dealt with. Her country is connected by the waters of Lake Chad, across the angle of British and German territory, with Baghirmi. The projected railway across the Sahara from the Mediterranean to the lake will no doubt be given up, since there is nothing there to pay for the railway; but that across the desert by Ain Saleh to Timbuktu will probably be built. In Baghirmi, on the Shari, France is in considerable strength, watching the fanatical Moslems of Wadai. Up till now there has been great difficulty in relieving and supplying the Shari garrisons. The line of communication is extremely long, being by way of the French Congo, along the Congo and Ubanghi, over the watershed, and down to the Shari valley—a journey of four or five months. It is possible, however, that this will be altered, as a result of Commandant Lenfant's recent discovery. That officer, acting on the theory that the great Tuburi marsh might in the rainy season form a waterway between the Kebi and Logone rivers, started up the Benue in the latter part of 1903, and succeeded, under considerable difficulties and dangers, in getting a light boat through from Garua, on the Benue, by way of the Kebi, the Tuburi marsh, and the Logone, to the Shari. It was a fine piece of exploration,

and fully earned the welcome he received when he returned to Paris.

Commandant Lenfant now suggests that the Baghirmi country should be evacuated on account of its want of resources, and that the French should be posted in the western angle of the frontier, near Lata, in the Kebi valley, where there is a rich country, and continuous water-communication by the Kebi, the Benue, and the Niger to the ocean.

We left England with the German Commission on January 17, 1903, and arrived at Lokoja on February 10. Leaving Lokoja and civilization on the 20th, we travelled 250 miles up the Benue by canoe to Ibi, and then marched another 250 miles, arriving at Yola on April 4. Four months were occupied in astronomical work and the triangulation of the Yola arc. August was spent at Yola in recording results and re-organizing the carriers, and on September 1 the headquarters of the commission crossed the Benue and started north. The survey was pushed rapidly across the hills, a distance of about 100 miles, under considerable difficulties of weather, the rainy season being at its height. Later, in the Bornu plain, a great delay was caused by the necessity of cutting avenues through the thick bush for the triangulation. By the end of the year, however, we reached Kukawa; and by the middle of February, 1904, the work was finished on the shore of the lake. Marching south, we left Yola for home on April 4, just one year after we marched in.

The Niger and the Benue are, of course, the two important waterways of Nigeria, and are to us of vital importance in facilitating communication and the supply of outlying stations. The Benue is almost as large a stream as the Niger. Its bed, for a long distance above Lokoja, is perhaps a mile wide in many places, with banks from 15 to 20 feet high, and a sandy bottom, whose shape is constantly altering. In flood time it runs bank high, and in many places overflows. At the end of the dry season there is so little water left that there is sometimes difficulty in getting passage for a canoe drawing 9 inches of water. At Yola, nearly 600 miles (as the river flows) from the confluence at Lokoja, I have forded the river in the dry season with the water no higher than my horse's girths; and on September 1, towards the end of the rains, it took me an hour to get across in a fast canoe, the stream being about three-quarters of a mile wide and very strong. In flood time the river is navigable as far as Garua, 70 miles above Yola, by river steamers drawing 4 or 5 feet. At low water one may travel very comfortably in flat-bottomed steel canoes, of which, however, there are very few available, or in large native dug-outs, about 40 feet long and 4 feet beam, with shelters built amidships to keep off the sun. We started in a steel canoe which had been fitted with engines and a stern wheel, but she broke down 30 miles above Lokoja, and we had to go on in the best canoes we could get from the river-side villages, ordinary

dugouts without shelters. We sat in these from sunrise to sunset for eighteen days, camping at night on the banks, and certainly began our African experience with a baptism of fire. We had arrived at Lokoja with somewhat trusting natures, and had been confidently assured that the steam-canoe would run us up to Ibi in three or four days, so we provisioned for a week. Of course everything ran out—flour, tinned meat, coffee, jam, whiskey, etc.—and we found the supplies in the river-side villages extraordinarily scanty. We just managed to get enough skinny goats and chickens to keep us going, with yams and guinea corn, out of which we made porridge and "bush-cakes," a sort of inferior damper. Now and then we passed some fishermen, and got fish.

After this rather tedious experience, it was a relief to get to Ibi, where we found the two officers of the escort waiting for us, and where they had collected carriers and horses. We had decided to march the rest of the way to Yola, as the river above Ibi was so low that there would be difficulty in getting through. A party of the Commission followed us by water with stores a fortnight later, but with much trouble, having to dig channels through the sand in many places.

We now had our first experience of carriers, one of the great problems of African travel. Although the construction of roads is being rapidly pushed forward now, when we were in Nigeria there were none, and wheeled transport was therefore impossible. African bush paths are the same everywhere—tracks worn by naked feet, irresponsible, infinitely devious, turning aside here to dodge a thorn branch grown across the track, there to avoid a pool of the last season's rain, but in general direction pursuing a wonderfully even course from village to village. In thick bush they are very tiring to ride over, as you must go at a walk all day, stooping and twisting constantly in the saddle to avoid trees and overhanging boughs. In the rains the tracks, which are below the surface, become channels for running water. In Bornu, where there are large open and treeless stretches, there is another difficulty, for the black earth is parched and cracked by the sun until there is hardly a clod left large enough for man or horse to put foot on. Again, in other parts, such as the Garua district, the surface skin of the earth rises up like a sort of blister, and when this is softened by the first rains, your horse is apt to put his foot through it, with possibly serious results.

Luckily, elementary road-making in Nigeria is extremely easy. It is a mere question of clearing bush, cutting down small trees and avoiding large ones; the long coarse grass can be pulled up by the roots and thrown aside, and the light soil is easily raked to a smooth surface. Anything like a metalled surface is of course out of the question, as, except in the hills, there is little stone in most parts. Rivers could be crossed by providing rafts of tree-trunks where no canoes are available. At present in the rains one must ford or swim. The most difficult

problem is the swamps, which are very common in the rainy season, so much of the country, even the bottom of the valleys among the hills, being quite flat, and having no natural drainage. Going north from the hills into the Bornu plain at the end of the rainy season, when the whole country was water-logged, we marched for three days through practically a continuous swamp, the water being in places as much as 4 feet deep, with a soft bottom. No ordinary engineering can deal with that, and such districts must remain difficult in wet weather.

At Ibi a force of three hundred carriers had been collected, with some difficulty, as the supply is now less than the demand. These were mostly professional Hausa carriers, fine specimens many of them, who stayed with us throughout the journey. Though they gave us a good deal of trouble at the outset, they shaped wonderfully under discipline and fair treatment, and we had a real respect and liking for many of them at the end. They are irresponsible, and must be treated like children; but, like children, they have a strong sense of justice. If they have earned punishment, and it is meted out to them dispassionately, they take it without bearing a grudge. When they have a fit of the sulks, a word of chaff or a little serious reasoning brings them out of it very easily; but they like to have their grievances listened to. Their faults are mostly on the surface, but pretty well marked. They fight, drink, and gamble, and if they are not kept well in hand they are a pest to any country they pass through, sheep-stealing and robbery with violence being their natural pursuits in moments of leisure. Thanks to the experience of Captain MacCarthy Morrough, who commanded the escort, we made a practice from the outset of camping outside villages, and not allowing the men into them. If any king, as the local headmen are called, complained of theft or assault, the carriers were paraded; if the offence was proved, and the sinners identified, they were punished and the victim compensated. We thus acquired a reputation for fair dealing which preceded us, and was of great use when we got into parts where the white men and his ways were little known, and where the advent of a small army of soldiers and carriers seemed like a serious menace to the population.

With these faults they have the virtues of patience and endurance. They will do heavy marches on half or even quarter rations without a murmur if they know you are doing your best to get food for them. A full day's ration, as much as they can eat, is 3 lbs. of flour. With this they like occasionally, as a treat, a small fragment of meat. The flour is made into porridge, and with soup from the meat and a little of a vegetable like spinach to flavour it, they have a feast, but usually they live on the porridge alone. Sometimes they like to gorge themselves on meat, and no part of an animal comes amiss to them; but if you feed them on meat alone, especially beef, for two or three days, as we sometimes had to do, they get sick.

At Yola we found the Fulani inhabitants not inclined to be friendly, but the Hausa and others who were not of the ruling class before our arrival had no prejudices. Away from Yola, especially in out-of-the-way places where they had not been much in touch with the ruling clique, there was less bad feeling among the Fulani. They are, however, not satisfactory people to deal with, being unpractical and unreliable. Of all the people with whom we came in contact—Hausa, Bornu, Pagan, etc.—I consider them the most untrustworthy. They are grasping, but lazy, and their intelligence is unproductive, and seems to have found its vent only in ruling without governing. My relations with them were chiefly on the food question, which was a constant anxiety and preoccupation. One reason for this was that there was an actual scarcity of corn, in fact, something approaching to a famine, while we were in Adamawa. Another, that, owing to the absence of markets of any size and the impossibility of dealing direct with the people, we had to get the supplies from the "kings" or headmen of towns, and no doubt very little of the cloth paid to them found its way to the actual growers. They were thus unwilling to bring it in, and the authority of the kings was not enough to make them.

The process of obtaining supplies under these conditions was always extremely irritating. You arrive at a village perhaps at three o'clock, after the day's march, send for the king, and tell him you want, say, eighty calabashes of corn. He promises earnestly to send this immediately, and retires to give orders. At six o'clock, as it is getting dark and you are losing patience, a procession of women comes out bearing twenty calabashes. You say that you must have more at once, and, after many promises and messages, perhaps at nine o'clock another small supply comes. Meanwhile you have been waiting to give out rations, and the carriers are going to sleep after another hungry day. It is a farce that is played with endless variations. A really good interpreter, a man of importance who carries weight with the people, is the best solution of the difficulty.

The relations of the Pagans with the Fulani in Adamawa were of considerable importance, to us. I have mentioned that it was chiefly thanks to their horses that the latter defeated them and drove them to the hills. The greater part of Adamawa is hilly, the Kamerun range extending northward through it to the edge of the Bornu plain, about 100 miles south of Lake Chad. These hills are of granite, and may perhaps be called mountains, as they range from 1000 to 3000 feet above the river-level, which is here 1000 feet above the sea. They lie in very irregular isolated masses, ridges, and peaks, separated from each other by comparatively level valleys, where, when the bush is cleared, cavalry can act. The Bere hills just south of Yola (shown on the hand map) give an example of such an isolated mass.

The relations between the men of the hills, the plains, and valleys

are practically the same as those of the highlands and lowlands of Scotland two hundred years ago. When the hill mass is large, as in the Pakha, Mandara, and Kilba regions north of the Benue, the tribes become powerful, and are not only safe in their hills, but can exercise influence in the neighbouring plains. In the smaller mass of Bere hills they are safe, but dare not venture into the plain, except for an occasional cattle-raid. In the isolated hills they live miserably, cut off from the rest of creation, and only existing by sufferance of the Fulani. It is needless to add that the hill tribes have their feuds among themselves. Some tracts of bush at the foot of the hills are a sort of no-man's-land, where neither Pagans nor Fulani dare venture for fear of the other party.

It was, of course, from the Pagans that the Fulani drew their slaves, and they used to make annual raids into the outlying hills for the purpose, as did also the Bornu people.

The state of armed isolation in which these people live makes them, of course, intensely suspicious of the outside world. Some tribes are quite impracticable; but with most of them we did not find it difficult to establish friendly relations. Our usual plan was to get a man from a village in the foothills who had some relations with the hill people, and had seen our ways, and could report well of us, and send him up with a message and a small present of cloth. Upon this the king would come down to our camp and have a talk, and next day would guide us up to his hill. Approached like this, we found them simple and friendly, curious as monkeys, delighted with small presents, and anxious to help in putting up survey-beacons or other ways. Physically they varied a good deal; some tribes had a good deal of the missing-link type, while others were quite fair specimens of manhood. They are good farmers, and their fields in the hills look very neat, and are far better kept than those of the Fulani.

One result of the state of isolation and mutual fear in which these people all live is the extraordinary difficulty of getting correct information about the country. The fog of war is nothing to it. For instance, when we were in the foothills of Alantika, not 30 miles from Yola, at a time when food was very short, I was told that at a place called Uomini, at the foot of the hills, half a day's march away, there was a powerful and warlike Pagan king who had a town far bigger than Yola and plenty of food. I sent a message to him that I was coming in a day or two, and wanted food. The messenger came back saying that he had been driven out by the king, who told him that he would have no white men there, and if we came he would fight. I sent another and more reliable messenger to tell the king that I came as a friend, but that if he made trouble, I had soldiers enough with me to burn his town and twenty like it. In point of fact, we had at that time six soldiers in camp, but it was not necessary to say so. The second messenger came

back, saying that the king had climbed down; he had plenty of food, and would send it or keep it for us as might be ordered. The ridiculous end to the affair was, that when we reached this rumoured stronghold we found a Pagan village of about five hundred people, and a decrepit and apologetic king who claimed a sovereignty, which no one else allowed, over some neighbouring villages—and there was no food.

Although we had some sympathy for the Pagans, as being, perhaps, on the whole more sinned against than sinning in their relations with their late Fulani rulers, it must be allowed that they are the chief source of trouble in the country. The plains people understand and recognize British authority, but the Pagans are Ishmaels, recognizing no one, and, like the little girl with the curl, "when they are bad they are horrid." They are especially mischievous in interfering with trade by blocking roads and murdering traders. This reminds me of a trader who wanted to join us for protection when we marched south from Dikoa. He could not get away in time, but he caught us up at Uba, about 100 miles farther south. He was dishevelled, but very pleased with himself. He told me that he had been stopped by the people at Dure, who had taken his merchandise and his wife; but when they wanted his horse, he said, "No, no;" he drew the line there, and he beat them off with his spear and got away. His point of view was quite simple: he had probably paid about the same amounts for the horse and the wife, but the horse was indispensable to enable him to get away, and the wife was not. This seems, in fact, to be the normal point of view of the native. It very often happened that a man would come and complain that his wife had run away with one of the carriers, and the burden of his complaint always was that he paid so much—perhaps £3—for her two or three years ago. When the lady was sought out and produced, and he was asked if he wanted to take her back, he always said he would rather have the money.

Turning now to geographical considerations, the most important question, of course, is Lake Chad. In order to give a general idea of the southern drainage system, the results of Commandant Lenfant's recent exploration have been added to the hand-map. They are taken from the map at the end of his book, 'La grande route du Tchad.'

Considering first the hills, we find that south of Yola they are spread in irregular masses, separated by well-marked valleys, covering a space of perhaps 100 miles from east to west. Of this country we have at present no accurate surveys. The Benue, from above Garua to Yola, flows through a great valley, of more or less oval shape, some 80 miles long by 40 wide. North of this valley we have still the same irregular masses, a broken sea of granite peaks, as in the south, whose summits are all at about the same level, of 1500 to 2000 feet above the river, which at Yola is nearly 1000 feet above the sea. Fifty miles north of the river, however, beyond Holma, we open up the Yedseram valley,

which runs uninterruptedly, broadening as it goes, north-north-east along the boundary, into the Bornu plain. East of the valley, in German territory and separating it from the Musgu flats, runs a mountain chain of striking character, gradually narrowing till it terminates in an isolated peak at Zalladufa. In the southern portion of this range, where the granite predominates, are some of the most remarkable rock formations that I have ever seen, natural towers, battlements, and pinnacles crowning the hills, and giving individuality to each one. On one of them there is probably the finest natural obelisk in the world. This is Barth's Mount Kamalle, but it is so slightly mentioned by him that he must have seen it in a bad light. Standing symmetrically on the summit of a high conical hill is a gigantic pillar of rock. Seen from 20 miles away through the clear atmosphere of the rains, it looked like a huge factory chimney. Measured with the theodolite, it appeared to be 450 feet high, and 150 feet thick at the base.

All the granite country of Adamawa is picturesque, even in the dry season. In the rains the soft pinks and greys of the rock, half veiled by creepers and long grass, are wonderfully pleasing after weeks of riding through the dreary African bush. The Mayini valley, south of Yola, would be thought beautiful even in Europe. There are green glades studded with great shade trees, a silver river winding through them, softly undulating wooded hills around, and in the distance the granite peaks, with a bright thread of waterfall—everything that delights the educated eye.

On the western side of the Yedseram valley the hills are scattered in less-defined masses, and present no special features.

The watershed between the Benue and the basin of Chad is near Mubi, where the Kilunga and Yedseram rivers, issuing from the hills to the west within 5 miles of each other, flow south and north respectively. Beyond the eastern hills, the water-parting is at the Tuburi marsh. This great swampy lake lies on a plateau considerably above the Benue valley, and feeds both the Benue and Chad. It is drained northward through the Musgu and Kotoko flats by the Logone, and westward over the cataract of Lata, 370 feet high, by the Mayo Kebi to the Benue. The success of Commandant Lenfant's mission lay in discovering the connection, and proving that there is a practicable waterway in the rains for boats drawing 2 feet. It is now possible to go by water the whole way from the Niger to the Shari with only one portage, at the cataract of Lata.

The Yedseram river and the Tuburi supply, of course, a good deal of water to the lake, but by far the most important feeder is the Shari, of which, indeed, the Logone is only a tributary. After the Shari in importance is the Yo river, coming from the highlands of Kano.

Considering the lake generally, and the changes which are taking

place in its shape, we find that these are occurring in the east and south. On the east it is being filled up by the sand blown from the desert, aided by luxuriant growth of vegetation. On the south, the loss of area is principally due to the dropping of the surface level. The presumption is that the rainfall is decreasing; partly, no doubt, in consequence of the deforestation of the country, which is aided by the annual burning of grass and bush by the natives. This point is well brought out by Lenfant. The bed of the lake in the south is so extremely flat that a shrinkage of a few inches in the surface level makes a sensible difference in the area of the lake.

The lake, as we know it, is the residuum of a far larger inland sea, which must have extended southward to the base of the Marghi and Mandara hills, and far towards the Tuburi marsh. Lenfant is of opinion that this sea discharged itself through the Benue into the Atlantic, that the connection was lost by subsidence, and that the desiccation has been going on ever since. Whether there was such a connection or not, I certainly formed the opinion, when in the mountains south of Yola, that the Benue was once of immense volume, and that not only the Benue valley, but the valleys among the hills, several hundred feet above the present level of the river, were formerly under water.

Following the valley of the Yedseram, we find stony ground and outcrops of rock as long as we are quite close to the base of the hills. When we leave them, for a few miles there is gravel, gradually growing finer, then sand. From this on the country is almost dead level, and we soon come to the deposits of sediment (known as the Bornu black earth) that mark the comparatively recent presence of the lake. Westward, that is south-west of the lake, the ground undulates slightly, and there on the higher levels the surface is all sand, with a slight admixture of humus.

To the east the ground is all of the nature of a delta, covered with swamps in the rains, and partially drained by an infinite number of shallow channels. The great difficulty of surveying these has led to inaccuracy in previous descriptions of the course of the rivers. Thus Barth describes the Maiduguri river as flowing by Dikoa and Ngala to the lake. So much respect is due to Barth's statements, that it would be unsafe to say that it did not do so in his time; but at present it flows past Maiduguri in the opposite direction, and, as far as we could conjecture, must lose itself in the sand somewhere to the north-west, as there was no recognizable outlet for it to the lake between Dikoa and Kukawa. The Yedseram river flows by Dikoa, but a few miles further on loses itself in an extensive marsh, and only a portion of its water gets down to the lake by a well-marked channel that drains the north side of the marsh past Urge; and it is apparently the Bahr Afade, a branch of the Logone, that flows past Ngala. This river continues to flow

till late in the dry season, long after the Yedseram swamp has dried up.

There can be no doubt, from the French observations, that the shrinkage of the lake, due to the deposit of desert sand on the eastern shore and in the Shari delta, is going on fast; but I do not think that the level of the lake is falling as rapidly as is generally supposed. This is a point on which it is impossible at present to have definite knowledge, as the level varies so much from year to year according to the rainfall. Native evidence, of which I took a great deal, is vague, and not always consistent. Some will tell you of a cycle of eleven years governing the highest floods. One old man told me that forty years ago the floods used to come every year close round the walls of the town of Seram, opposite Ullgo (perhaps 8 feet above the present low-water level of the lake), but that they have been gradually receding ever since. Colonel Destenave gives 4 feet as the difference between high and low water, from his observations in 1902. I am inclined to think that the old native exaggerated his maximum level largely.

As regards the alleged continuous fall in the floods, we have, on the other hand, the fact that the great flood in 1854, recorded by Barth, and Rabeh's flood, as it is called, in 1893, both reached approximately to the same point on the west, namely, the town of Ngornu.

Perhaps the most interesting feature about the lake is the second flood. The first rise of the lake comes with the rains; the second, which is expected to be the greatest, comes in the middle of the dry season, about Christmas.

The rainy season is over in Bornu towards the end of September, at which time most of the country for miles round the south end of the lake is under water. By the middle of November the flood of the Shari is practically over, and the smaller rivers are bringing down nothing. The lake recedes, and at Christmas rises again, as a rule higher than before. The rise is, therefore, not due to the rivers, or to rain; it comes after a spell of the strong north-east wind. The natives say, "Chad likes cold." It was most unfortunate that in the winter of 1903–4, when we were there, the second flood failed altogether.

It is on the southern bay of the lake, which is almost entirely filled up with long grass, bulrushes, and marya, growing 8 or 10 feet above the water, that one gets the clearest descriptions of this rise, which is a real definite rise. One gets no clear account of a similar rise on the open western share. There the water, when driven before the strong north-east wind, may spread itself from time to time over half a mile or so of the flat ground, and retire as soon as the wind goes down. It is possible that the second flood, as it was described to me, may occur only in the southern bay; that the northern edge of the area of vegetation blocking this bay may resist the pressure of the water driven by this

wind for a certain time, and then when it yields the water rushes in; but I do not venture to offer an opinion.

A few notes on the survey operations of the commissioners, which were carried out by Captain Whitlock and Lieuts. Jackson and Doucet, R.E, may be of interest.

For the longitude of Yola, the British commission relied on occultations, using a 2½-inch astronomical telescope made by the late Dr. Common. It was an excellent instrument, but a larger one would have been better. The German commission took out a fine altazimuth, with a special observatory tent and materials for making a concrete pillar, and they worked by moon culminating stars. For the special conditions under which we worked, this method was probably the best, for several reasons, one of which was that we could not reach Yola before the clouds began to gather for the wet season, and consequently most of the occultations were hidden; but, as a general rule, I should certainly recommend the occultations.

The base for the triangulation was 1¼ mile, that being the longest that could be got on fairly level ground. It was measured four times with a 100-feet steel tape, the greatest difference between the measurements being 8 inches. A 400-feet steel tape was tried, but was found difficult to handle. From this base, triangles were built up until we got a line about 32 miles long from Mount Bagele to Beruere. The length of this line was worked out from two separate sets of triangles, which gave results agreeing within 6 inches. It was the base for the triangulation carried up to the lake, as well as for the Yola arc of about 30 miles' radius. The theodolites used were a 6-inch and a 5-inch micrometer microscope (by Troughton & Simms), which answered extremely well, though they had unavoidably some very rough usage.

A good deal of trouble was experienced in laying out the small triangles from the original base, on account of the difficulty of getting points of view in the undulating and thickly-wooded valley of the Benue. Once in the hills, this difficulty disappeared, not much clearance as a rule being required.

The triangulation beacons were tripods of poles, mostly 12 to 15 feet high, about 4 feet of the top being covered with straw mats, which were worked to a point at the top; the tips were bound with black and white cotton cloth. For the longer lines, heliographs were used in conjunction with the beacons.

When we left the mountains, going north into Bornu, a great difficulty appeared in the flatness of the country, which was also densely wooded. This was made worse by the fact that most of the country north of the hills was at that time under water, and marching was extremely difficult. After a good deal of trouble, a couple of points were found near Malmatari, from which the peak of Zalladufa could be seen.

The longitude of these was got by latitude and azimuth, and thus a fresh base was obtained.

At Malmatari we were 30 miles from Dikoa, and the whole distance was covered with thick bush, with a great many hard-wood trees, through which avenues had to be cut for the triangulation. This work was very tedious, the rate of advance being only half a mile a day. As I had been told that Bornu was practically treeless, we were very short of tools, and had to fall back on native axes. Luckily, after our experience in the Benue valley, I had got up several 5-feet crosscut saws from Lokoja, which were invaluable. We ought to have had five dozen felling axes, six crosscut saws, and some guncotton. The work was done by the carriers. They did not like it, and, if the Pagans had not been between them and their homes, would have deserted *en masse;* but they worked well after they got used to our tools.

After Dikoa, though we sometimes met with bad stretches of bush, the work was not so heavy, some of the ground being absolutely clear, with nothing growing but coarse grass.

A further difficulty, caused by the heat in Bornu, was that, owing to the vibration of the atmosphere, it was impossible to observe accurately except for an hour after sunrise and an hour before sunset.

The results of the triangulations carried up from Yola by the British and German commissioners differed at Kukawa by 11 seconds of latitude and longitude.

Before the paper, the PRESIDENT: I have great pleasure in introducing Colonel Jackson to the meeting, who has been employed on the Anglo-German Boundary Commission, and has done a great deal of very valuable geographical work. I am quite sure the paper he is going to read to you this evening will be extremely interesting. I now ask Colonel Jackson to read his paper.

After the paper, Colonel ELLIOT: I did not expect to be called upon, but I have listened with great interest to what Colonel Jackson has said, and I notice he had very much the same difficulties as I had. He spoke a good deal about food. Food is one's first thought, and it is a very great difficulty to get food in these districts. Another question was transport—that was also a great difficulty. Colonel Jackson appears to have suffered a great deal from swamps. I suffered from the opposite—lack of water and dust. I also had the same difficulty as he had about the question of the ladies with our own caravan, and eventually I had to give in. I found them fearful thieves; that was what I objected to them for chiefly. They would go into the village and lay their hands on whatever they could, and get the men into trouble. But I found they were such good cooks, and looked after the men so well—and our men had very hard work indeed—that eventually, without saying so, I had to give in on that point. Colonel Jackson has thrown a lot of extra light on the subject of Lake Chad. I was not there as long as he was there, and I was very much puzzled to account for the rise and fall of the lake. I noticed bones of large fish at some considerable distance away from the shores of the lake, which shows there is a great rise and fall of the lake. I understand that there was a sort of periodical rise and fall of the lake; the lake had a period of some years, but, from what Colonel Jackson says, it is an annual or a biennial period. What Colonel Jackson saw I saw in a less degree. My first

view of the lake was very much what Colonel Jackson described. You came on the lake without knowing you were there. We came out of a patch of bush, crossed a grassy plain covered with game, and then we saw greener grass ahead, and there was water; we kept on getting into deeper water, and we were in Lake Chad. But there was no large open stretch of water such as we expected to see. I think that is about all I can say on the subject.

The PRESIDENT: We have to thank Colonel Jackson for a most interesting account of his journey from the Benue to Lake Chad, and for his account of the people and the incidents of his travel. It was very pleasing to hear this testimony to the nerve and pluck of Captain Lenfant, who has done so much to add to our information respecting this very interesting region. The latter part of Colonel Jackson's paper gives us some notion of the changes that have taken place, probably within historic times, many of them caused by the action of man, in this great region, which has altered the flow of rivers and very much reduced the size of the once great inland sea. I am sure you will all wish to join with me in a very cordial vote of thanks to Colonel Jackson for his most interesting paper.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART VIII.—THE LOCHS OF THE CONON BASIN.

IN this paper it is proposed to deal with the lochs draining into the Cromarty firth, which were surveyed by the staff of the Lake Survey, viz. Lochs Crann, a' Chroisg, Gown, Achanalt, a' Chuilinn, Fannich, Luichart, Beannachan, Achilty, Garve, Kinellan, Ussie, Glass, and Morie.† The majority of these lochs drain by the river Conon into the head of the Cromarty firth, while Lochs Glass and Morie drain by independent streams, which fall into the Cromarty firth on its north-western shore. It has been found convenient, also, to include in this paper a description of Loch Eye, situated between Cromarty firth and Dornoch firth. The drainage area under consideration is indicated in the small index map of the district shown in Fig. 1, by reference to which the relations between the various lochs will be readily understood, and extends from the mouth of the Cromarty firth on the east to the heights of Carn Breac and An Groban on the west, Carn Chuinneag on the north, and Sgorr a' Choir-Ghlais on the south. The total area, as measured by the planimeter on the 1-inch Ordnance Survey maps, is over 770 square miles, and of this total 336 square miles (or one-half) drain into the lochs now to be dealt with, as will be seen from the summary table at the end of this paper.

The headwaters of the basin take their rise on the flanks of Carn Breac, flowing by various streams into Loch na Moine Moire and Loch

* Plates, p. 128.

† The names of the various gentlemen who have taken part in the survey of the lochs in this basin will be found recorded on the maps.

an t-Sior (which were not sounded), thence into Loch Crann and Loch a' Chroisg, the outflow from which is carried by the river Bran into Loch Achanalt and Loch a' Chuilinn, and thence into Loch Luichart. Shortly after leaving Loch a' Chroisg the river Bran receives the outflow from Loch Gown, which is fed by the Allt Gharagain, taking its rise on the flanks of Moruisg (3026 feet), and shortly before entering Loch Luichart the river Bran is joined by the river Fannich bearing the outflow from Loch Fannich, which is fed by various streams draining the flanks of a grand series of mountains exceeding 3000 feet in height. After the junction of the Bran and the Fannich the river receives the name of Conon, and shortly after leaving Loch Luichart it

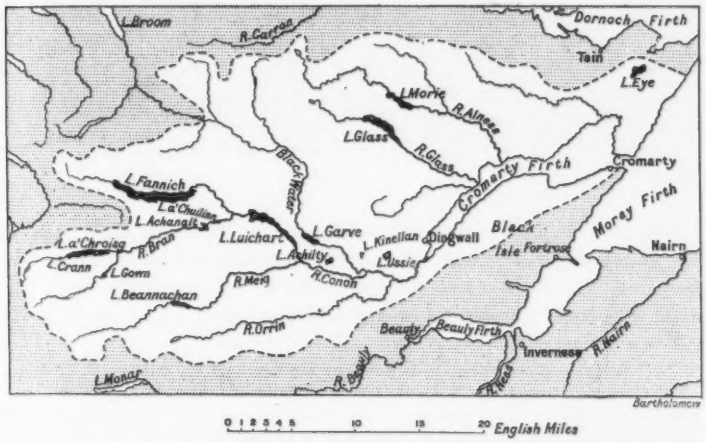

FIG. 1.—INDEX MAP OF THE CONON BASIN.

is joined by the river Meig, bearing the outflow from Loch Beannachan, taking its rise among lofty mountains culminating in Sgurr a' Chaoruinn (3452 feet). Still further on the river Conon is joined by the Black Water, bearing the outflow from Lochs Garve and Achilty, and taking its rise far to the north on the flanks of Beinn Dearg (3547 feet). Still further on the river Conon is joined by the river Orrin, and finally falls into the head of the Cromarty firth at Dingwall. The river Glass, which in its course flows through Loch Glass, rises on the flanks of Beinn nan Eun, and empties itself in the Cromarty firth at Balconie Point. The river Alness, which flows through Loch Morie, rises on the flanks of Beinn a' Chaisteil, and falls into the Cromarty firth at Alness Point.

The geology of the district is dealt with by Drs. Peach and Horne, whose notes are appended to this paper, as well as a few biological notes by Mr. James Murray. Mr. R. M. Clark, B.Sc., who took part in

the survey of the lochs in the Conon basin, has supplied us with several series of temperatures taken by him the previous summer (1901) in Lochs Achilty, Garve, Achanalt, a' Chuilinn, and a' Chroisg, which are here incorporated.*

Loch Crann (see Plate I.).—Loch Crann is a small shallow loch situated a short distance to the west of Loch a' Chroisg, and lying at a slightly higher level. Its striking characteristic is the large area of hilly country draining into it—an area nearly six hundred times greater than that of the loch. It is roughly quadrangular in outline, with a maximum diameter of less than a quarter of a mile, and it covers an area of about 13½ acres, 80 per cent. of which is under less than 10 feet of water. The deeper soundings were taken in the southern half of the loch, the maximum depth observed being 17 feet. The volume of water is estimated at 4 million cubic feet, and the mean depth at nearly 7 feet. Loch Crann was surveyed on August 19, 1902, when the level was determined as being 513·7 feet above the sea. The temperature of the surface water at 5 p.m. on that date was 59°·6 Fahr., and at a depth of 14 feet 56°·2.

Loch a' Chroisg (see Plate I.).—Loch a' Chroisg (or Loch Rosque) is one of the larger and more important lochs within the basin, lying amid beautiful scenery, the hills on both sides rising to heights exceeding 1500 feet, and culminating in Meall a' Chaoruinn (2313 feet) on the

* These temperature observations, taken by Mr. Clark in the summer of 1901, are interesting, as compared with the observations taken in the same lochs in the summer of 1902, when viewed in connection with the atmospheric conditions in the two seasons. It will be observed that all the readings taken in the superficial waters of these lochs in 1901 are higher than those taken in 1902, and this is evidently related to the warmer season in the first-named year. Thus the mean temperature over Scotland for July, 1901, was 61°·8 Fahr., or 3° above the long-period average for that month, while for July, 1902, it was 54°·4, or 4½° below the average; for August, 1901, the mean was 57°·5, or 1° above the average, while for August, 1902, the mean was 53°·9, or 2½° below the average. The nearest station to the Conon basin lochs from which observations are available is Inverness, and the mean temperature there for July, 1901, was 61° 0, or 4° above the long-period average, while for July, 1902, the mean temperature was 45°·4, or 3½° below the average; for August, 1901, the mean was 58°·7, or 2° above the average, while for August, 1902, the mean was 54°·2, or 2½° below the average. Sunshine records are available for Strathpeffer within the Conon basin during these seasons, and they bear the same relations: thus during July, 1901, 162·1 hours of sunshine were recorded at Strathpeffer (or 34·5 above the normal for that month, and 30 per cent. of the possible amount), while during July, 1902, the duration of sunshine was 95·6 hours (or 32·0 below the normal, and 18 per cent. of the possible amount); during August the difference was not so marked in the two years, the duration in August, 1901, being 140·0 hours (or 18·5 above the normal, and 30 per cent. of the possible amount), while in August, 1902, the duration was 131·8 hours (or 10·3 above the normal, and 28 per cent. of the possible amount). The sunshine records for Inverness agree closely with those given above for Strathpeffer for the two seasons under consideration.

FIG. 2.—LOCH A' CHROISG, LOOKING WEST.
(*Photo by T. N. Johnston, M.B., C.M.*)

FIG. 3.—LOCH FANNICH, LOOKING EAST.
(*Photo by T. N. Johnston, M.B., C.M.*)

northern shore (see Fig. 2). It is a good trout loch, and char also occur, but the fishing is strictly preserved. The loch trends almost due east and west, though very slightly sinuous in outline; the shore-line is on the whole very regular, except that two conspicuous alluvial cones have been laid down on the northern shore at the mouths of the Allt Duchairidh and neighbouring stream. The loch is $3\frac{1}{2}$ miles in length, with a maximum breadth of nearly half a mile, the mean breadth being over a quarter of a mile. Its waters cover an area of about 640 acres (1 square mile), and it drains directly an area of over $7\frac{1}{2}$ square miles, but as it receives the outflow from Loch Crann its total drainage area is over 19 square miles. The maximum depth of 168 feet was observed approximately near the centre of the loch, opposite the mouth of the Allt Duchairidh entering the loch on its northern shore, and about 2 miles from the east end. The volume of water contained in the loch is estimated at 2057 million cubic feet, and the mean depth at nearly 74 feet. The loch was surveyed on July 30 to August 1, 1902, and the elevation of the lake-surface, on commencing the survey, was found by levelling from bench-mark to be 508·4 feet above the level of the sea; when levelled by the Ordnance Survey officers on July 3, 1868, the elevation was 507·9 feet above sea-level.

Loch a' Chroisg forms a simple basin with no pronounced irregularities of the lake-floor, as is well shown by the longitudinal and cross sections on the map; the contour-lines enclose continuous areas following approximately the outline of the loch. The 100-feet basin exceeds 2 miles, and the 50-feet basin is nearly $2\frac{3}{4}$ miles, in length, approaching in each case rather nearer to the east than to the west end of the loch, while the small 150-feet basin lies nearer to the west than to the east end. The approximate areas between the consecutive contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 50	241 ...	37·7
50 „ 100	186 ...	29·0
100 „ 150	195 ...	30·5
Over 150	18 ...	2·8
	640	100·0

The slightly larger area between 100 and 150 feet than between 50 and 100 feet indicates the flat-bottomed character of the deeper part of the loch, and the soundings show in certain places rather steep slopes both off the northern and southern shores.

Temperature Observations.—In the following table are given the results of a series of temperatures taken in Loch a' Chroisg on August 22, 1901, by Mr. Clark, and of two series taken by the Lake Survey staff on August 1, 1902:—

Depth in feet.	August 22, 1901 (R. M. Clark).	August 1, 1902, ½ mile from E. end of loch in 106 feet.	August 1, 1902, Deepest part of loch in 156 feet.
	° Fahr.	° Fahr.	° Fahr.
0	58·2	55·0	54·0
20	58·2	—	—
25	—	53·7	53·9
40	58·0	—	—
50	—	53·1	53·2
60	57·6	—	—
75	—	53·3	51·0
80	51·9	53·2	—
90	—	50·5	—
100	48·5	49·9	49·1
120	47·5	—	—
150	—	—	48·9

The series taken in 1901 shows a range from surface to bottom amounting to 10°·7, whereas the two series taken in 1902 show a range of only 5° in each case, and an extreme range of 6°. The upper layers of water down to a depth of 60 feet were much warmer in 1901 than in 1902, but between 60 and 100 feet the 1901 observations indicated a fall of 9° (viz. a fall of 5°·7 between 60 and 80 feet, and a fall of 3°·4 between 80 and 100 feet), so that the temperature of the bottom layers of water beyond 100 feet was lower in 1901 than was observed at these depths in 1902.

Seiche.—On August 19, 1902, between 4.30 and 5.30 p.m., a seiche was observed by Mr. James Murray within the shelter of the pier at the east end of Loch a' Chroisg, a light west breeze blowing at the time. The amplitude was a quarter of an inch, and the period about 11¼ minutes.

Loch Gown (see Plate I.).—Loch Gown (or Ledgowan) lies about a mile to the south-east of Loch a' Chroisg and is also a good trout loch, but the fishing is preserved. It trends in a north-east and south-west direction, is very irregular in outline, and about 1¼ miles in length. Though it may at one time have formed a single lake, it is now divided into two distinct lakes having, at the time of the survey, a difference in level exceeding 2 feet. This separation has probably been brought about mainly by the deposition of material laid down by the Allt Mhàrtuin, and the passage between them is obstructed by weeds, so that it is impossible to row a boat from one loch to the other, except after heavy floods. The two lochs are nearly equal in superficial area, but the southern basin is much deeper than the northern one.

South Loch Gown.—The southern loch is roughly quadrangular in outline, over half a mile in length, and nearly a third of a mile in maximum width, covering an area of about 55 acres, while it drains an area exceeding 13 square miles. The maximum depth of 52 feet

was observed relatively close to the north-eastern shore. The volume of water is estimated at 38 million cubic feet, and the mean depth at nearly 16 feet. The loch forms a simple basin, the 10-feet contour following approximately the outline of the loch and extending a short distance into the passage leading to the northern loch, and the 25-feet basin is centrally placed. Of the entire lake-floor only 13 per cent. is covered by more than 25 feet of water. It was surveyed on August 2, 1902, when the elevation was determined as being 524·4 feet above the level of the sea.

North Loch Gown.—The northern loch is more oblong in outline than the southern loch, so that while nearly equal in length its maximum width is less, viz. about a fifth of a mile. Its waters cover an area of about 48 acres, and it drains directly an area of about 1 square mile; but since it receives the outflow from the southern loch, its total drainage area is over 14 square miles—nearly 200 times greater than the area of the loch. The greatest depth observed was 17 feet, approximately near the centre of the loch. The volume of water is estimated at 14 million cubic feet, and the mean depth at nearly 7 feet. A constriction in the outline towards the southern end of the loch is accompanied by a slight shoaling of the bottom, the result being that a small 10-feet basin near the southern end, with a maximum depth of 13 feet, is separated from the large main basin. Of the entire lake-floor 22 per cent. is covered by more that 10 feet of water. It was surveyed on the same day as the southern loch (August 2, 1902), and the elevation was determined as being 522·1 feet above sea-level.

Temperature Observations.—Serial temperatures were taken in the deepest part of each loch, with the following results:—

Depth in feet.	North Loch Gown, August 2, 1902, 1 p.m.	South Loch Gown, August 2, 1902, 4 p.m.
	° Fahr.	° Fahr.
Surface	55·7	55·0
10	55·7	55·0
15	55·7	—
20	—	55·0
30	—	53·8
40	—	52·1

In the shallow north loch the temperature was found to be constant from surface to bottom, and in the south loch the temperature was constant from the surface down to a depth of 20 feet (though more than half a degree lower than in the north loch); between 20 and 30 feet the fall was 1°·2, and between 30 and 40 feet 1°·7—a fall of nearly 3° in the 20 feet of depth.

Loch Achanalt (see Plate II.).—Loch Achanalt is an irregular shallow

loch apparently in process of being silted up, the material brought down by the river Bran forming two long spits extending out towards the centre of the loch. The northern spit extends nearly across the loch, joining the islands, and leaving only a narrow passage close to the eastern shore, through which there was a strong current, and thus practically cutting the loch into two portions. The western shores are bordered by weeds. It flows into Loch a' Chuilinn by a short and rapid stream, the difference in level exceeding 4 feet; the Highland railway is carried over the passage between the two lochs. Loch Achanalt is approximately quadrangular in outline, its maximum diameter exceeding three-quarters of a mile, and it covers an area of about 160 acres, or one-quarter of a square mile. The deepest water was found comparatively close to the western shore, south of the entrance of the river Bran, where two soundings of 9 feet and two soundings of 8 feet were recorded. The volume of water is estimated at 31 million cubic feet, and the mean depth at 4½ feet—half the maximum depth. The area draining directly into Loch Achanalt is very large, exceeding 39 square miles; but since it receives the outflow from Lochs a' Chroisg and Gown, its total drainage area exceeds 72½ square miles, or 290 times the area of the loch. Loch Achanalt was surveyed on August 9, 1902, when the elevation of the lake-surface was found to be 365·1 feet above the sea; when levelled by the Ordnance Survey officers on May 9, 1870, the elevation was 364·7 feet above sea-level. The temperature of the surface water on the date of the survey was 57°·1 Fahr.; the temperature of the river Bran being 55°·2, and of the air 50°·8. On August 19, 1901, Mr. Clark observed a temperature of 60°·1 at the surface, and a temperature of 60°·4 at a depth of 5 feet.

Loch a' Chuilinn (see Plate II.).—Loch a' Chuilinn (or Culen) trends east and west, is irregular in outline, of varying width, and with an undulating floor. It is 1⅓ miles in length, with a maximum breadth of one-third of a mile. Its waters cover an area of about 113 acres, and it drains directly an area of nearly 1¾ square miles; but as it receives the outflow from Loch Achanalt, its total drainage area is over 74 square miles—over four hundred times the area of the loch. The maximum depth of 43 feet was observed approximately near the middle of the loch. The volume of water is estimated at 50 million cubic feet, and the mean depth at 10¼ feet. The bottom of Loch a' Chuilinn is most irregular; close to the west end is a 10-feet basin, with a maximum depth of 29 feet, the slopes of which are in places steep, depths of 20 and 21 feet having been found close in-shore. Separated from this western basin by an interval of about 600 yards, in which the depth does not exceed 8 feet, lies the central 10-feet basin, enclosing the maximum depth of the loch (43 feet), and here again the slope is steep,

one sounding of 29 feet being recorded close to the southern shore. Separated from this central basin by a short interval, 7 feet in depth, is a small eastern basin, with a maximum depth of 29 feet, and after another shallow interval the water deepens at the exit of the outflowing river, where soundings of 13 feet were taken. Of the entire lake-floor, 75 acres (or 67 per cent.) are covered by less than 10 feet of water, and 7 acres (or 6 per cent.) by more than 25 feet of water. The loch was surveyed on August 11, 1902, when the elevation of the lake-surface was found to be 360·8 feet above the sea.

Temperature Observations.—The following table gives the results of observations taken in Loch a' Chuilinn by Mr. Clark on August 19, 1901, and by the Lake Survey on August 11, 1902 :—

Depth in feet.	August 19, 1901 (R. M. Clark).	August 11, 1902.
	° Fahr.	° Fahr.
0	60·3	55·7
5	60·0	—
10	59·6	—
15	—	55·4
20	59·6	—
30	—	54·7
40	58·6	—

These observations show that the whole body of water was much warmer in 1901 than at the same season in 1902, the difference amounting on the average to about 4°; the range of temperature was in each case small.

Loch Fannich (see Plate III.).—Loch Fannich is the largest within the Cromarty firth drainage-basin, and is surpassed in depth only by Loch Glass. It is situated in Fannich deer-forest amid splendid scenery (see Fig. 3), the mountains along the northern shore rising to heights exceeding 3000 feet, including An Coileachan (3015 feet), Meallan Rairigidh (3109), Sgùrr Mòr (3637), Sgùrr nan Clach Geala (3500), Sgùrr Breac (3000), and A'Chailleach (3276). The trout-fishing is good, the fish being of fair size, but the loch is strictly preserved. The general trend of the loch is east and west, but the two ends have a tendency to bend slightly to the northwards. Loch Fannich is nearly 7 miles in length, the maximum breadth exceeding three-quarters of a mile, and the mean breadth is over half a mile. Its waters cover an area of 2300 acres (or over $3\frac{1}{2}$ square miles), and it drains an area ten times greater (over $35\frac{1}{2}$ square miles). The maximum depth of 282 feet was observed about $1\frac{1}{4}$ miles from the east end, and about $5\frac{1}{2}$ miles from the west end. The volume of water is estimated at 10,920 millions of cubic feet, and the mean depth at nearly 109 feet. Loch Fannich forms a simple basin, all the contour-lines enclosing continuous areas, though the

deepest part (exceeding 200 feet in depth) lies in the eastern half of the loch. The 50-feet area extends from end to end, coinciding approximately with the outline of the loch. The 100-feet area approaches to within half a mile from both ends, and is nearly 6 miles in length; there is a slight shoaling of the water opposite Rudha Mòr to 103 feet, with deeper water to the east and west. The 150-feet area is distant over $2\frac{1}{2}$ miles from the west end, and is over $3\frac{1}{2}$ miles in length. The 200-feet area is $2\frac{1}{2}$ miles, and the 250-feet area $1\frac{3}{4}$ miles, in length, and they approach to within three-quarters of a mile from the east end. The slight shoaling opposite Rudha Mòr has already been referred to, and a similar shoaling is observable within the 200-feet contour opposite Fannich Lodge, where the depth decreases from 226 feet to 212 feet, and increases again on proceeding eastwards into the 250-feet area; these two shoalings are indicated in the longitudinal section A–B on the map. A sinuosity is also seen in the 200-feet contour off the southern shore, opposite Fannich Lodge, due to the shoaling of the water from 202 to 191 feet, but on the whole the lake-floor may be said to be extremely regular in conformation. The cross-section C–D is taken across the loch in the position of the deepest sounding. The areas between the consecutive contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.				Acres.		Per cent.
0 to 50	...	...	...	658	...	28·6
50 „ 100	...	...	...	582	...	25·2
100 „ 150	...	...	...	418	...	18·1
150 „ 200	...	...	...	272	...	11·8
200 „ 250	...	...	...	220	...	9·6
Over 250	...	...	...	155	...	6·7
				2305		100·0

The regularity of the average slope of the bottom is indicated by the gradually decreasing areas between the contour-lines, and the comparatively large area within the deepest contour indicates the flat-bottomed character of the deeper part of the loch.

Loch Fannich was surveyed on August 13 and 14, 1902, and the elevation of the lake-surface was found, on commencing the survey, to be 821·9 feet above sea-level, which is identical with the level observed by the Ordnance Survey on May 27, 1870.

Temperature Observations.—The temperature of the surface water during the two days spent on the survey varied from 52°·7 Fahr. to 58°·1 (the air-temperature during the same period varying from 51°·8 to 57°·9). Two serial temperatures were taken on August 14, 1902, with the following results:—

Depth in feet.	August 14, 1902, 4.15 p.m., deepest part of loch.	August 14, 1902, 5.30 p.m., south-east of Rudha Mòr.
	° Fahr.	° Fahr.
Surface	53·0	54·0
5	52·0	—
10	51·9	—
20	51·6	53·0
40	—	52·5
50	51·0	—
70	—	50·0
100	48·6	46·7
130	—	45·7
150	45·6	—
200	44·9	—
250	44·5	—
281	44·4	—

Each of these series shows a range from surface to bottom of about $8\frac{1}{2}°$. The temperature was higher in the upper 40 feet of water towards the west end of the loch than in the deep water towards the east end, but at the depth of 100 feet the temperature was 2° lower in the former position. Off Rudha Mòr there was a fall of 2°·5 between 40 and 70 feet, and a further fall of 3°·3 between 70 and 100 feet (equal to 5°·8 in the 60 feet of water), while in the deepest part there was a fall of 2°·4 between 50 and 100 feet, and a further fall of 3° between 100 and 150 feet (equal to 5°·4 in the 100 feet of water). All the observations indicate a range of temperature throughout the entire body of water amounting to 13°·7.

Loch Luichart (see Plate IV.).—Loch Luichart is another large and important loch within the Cromarty firth drainage-basin, second as regards length only to Loch Fannich, though slightly inferior as regards superficial area to Loch Glass. It is a good fishing loch situated amid grand scenery, where Strath Bran bends to the south-east to join Strath Conon (see Fig. 4). Its general trend is north-west and south-east, bending round the base of Sgùrr Mairc-suidhe, and it is broadest at the north-west end, narrowing towards the south-east. It is 5 miles in length, with a maximum width of nearly a mile, the mean width being one-third of a mile. Its waters cover an area of about 1130 acres, or $1\frac{3}{4}$ square miles, and it drains directly an area of about $39\frac{1}{2}$ square miles, but since it receives the outflow from all the lochs described in the preceding pages, its total drainage area is very large—about $149\frac{1}{2}$ square miles, an area eighty-five times greater than the area of the loch. The maximum depth of 164 feet was observed about $1\frac{1}{2}$ miles, or about one-third of the length of the loch, from the north-west end. The volume of water is estimated at 3288 millions of cubic feet, and the mean depth at nearly 67 feet. The loch was surveyed on August 16, 1902, when the elevation of the lake-surface was found to be 249·8 feet above the sea.

The floor of Loch Luichart is irregular, there being three 50-feet basins separated by shallower water. The largest and deepest lies in the wider north-western half of the loch, and is about 2¼ miles in length, approaching to within less than 200 yards from that end. The central 50-feet basin is separated from the north-western basin by an interval of half a mile, in which lies the single small island in the loch, and where the depth in the centre at another place is only 5 feet, and is over 1¼ miles in length. Immediately to the south-east of this central basin there is a narrow constriction in the outline of the loch, in which a depth of 16 feet was recorded, succeeded by a slight expansion containing the third 50-feet basin, with a maximum depth of 55 feet and of small extent. The principal 100-feet basin in the north-western part of the loch is nearly 2 miles in length, and encloses the deepest part of the loch. Two small subsidiary 100-feet basins lie within the central 50-feet basin: one based upon an isolated sounding of 100 feet, the other near the south-eastern end having a maximum depth of 115 feet. The 150-feet basin is nearly a mile in length, and is distant three-quarters of a mile from the north-west end of the loch; the maximum depth of 164 feet was recorded near the south-eastern end of the basin. It is curious to note the difference in the outline of this 150-feet basin as compared with the outlines of the 50 and 100-feet basins enclosing it, for, while the shallower contours follow approximately the shoreline, and therefore enclose areas widest towards the north-west and narrowing gradually in the opposite direction, the 150-feet basin is widest towards the south-east and narrows gradually to the north-west as the outline of the loch widens out. At the same time the deep basin approaches nearer to the northern shore at its north-west end, while it approaches nearer to the southern shore at the opposite deeper end, so that at the position of the deepest sounding the slope off the southern shore is much steeper than off the northern shore, as is well brought out in the cross-section C–D on the map. The longitudinal section A–B down the centre of the loch shows the three basins included in the loch, each successively deeper on proceeding towards the north-west end. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 50	482 ...	42·7
50 „ 100	385 ...	34·1
100 „ 150	208 ...	18·4
Over 150	54 ...	4·8
	1129	100·0

Temperature Observations.—The following table gives the results of observations taken in Loch Luichart by Mr. Clark on August 25, 1901, and by the Lake Survey on August 16, 1902:—

FIG. 4.—LOCH LUICHART, LOOKING ACROSS THE HEAD OF THE LAKE.

(*Photo by Mr. David Brigham.*)

Depth in feet.	August 25, 1901 (R. M. Clark).	August 16, 1902, 5 p.m., deepest part of loch in 152 feet.	August 16, 1902, 6 p.m., near N.W. end in 93 feet.
	° Fahr.	° Fahr.	° Fahr.
0	60·6	55·9	56·0
10	60·0	—	—
20	59·6	55·8	—
40	59·1	—	—
50	—	54·8	56·0
60	57·2	—	—
70	—	—	56·0
75	—	51·6	—
80	50·9	—	—
90	—	—	48·5
100	50·5	48·4	—
150	—	48·0	—

The range of temperature shown by the 1901 observations amounts to 10°, while that shown by the 1902 observations amounts to 8°. The temperature of the upper 60 feet of water was higher in 1901 than was observed in 1902, as was also the case at a depth of 100 feet, but a lower reading was recorded at 80 feet in 1901 than at 70 and 75 feet in 1902. The two serials taken in 1902 show the effect of the strong wind which was blowing up the loch at the time of the survey, the maximum temperature observed extending down to a depth of 70 feet near the head of the loch, whereas $1\frac{1}{2}$ miles further down the loch the temperature was always lower, amounting to a difference of 1°·2 at 50 feet and 4°·4 at 70 feet, beyond which depth a much larger fall of temperature was observed towards the head of the loch than was recorded farther down (equal to a fall of 7°·5 in the interval of 20 feet between 70 and 90 feet in the former case, and a fall of 3°·2 in the interval of 25 feet between 75 and 100 feet in the latter case).

Loch Beannachan (see Plate II.).—Loch Beannachan (or Bennachran) is situated at the head of Strath Conon, amid wild moorland scenery. It trends in a west-north-west and east-south-east direction, narrowing towards the eastern end. It is over $1\frac{3}{4}$ miles in length, with a maximum breadth of one-third of a mile, the mean breadth being a quarter of a mile. Its waters cover an area of 267 acres, or nearly half a square mile, and it drains an area seventy-two times greater—an area exceeding 30 square miles. The maximum depth of 176 feet was observed approximately near the centre of the loch. The volume of water is estimated at 819 million cubic feet, and the mean depth at $70\frac{1}{2}$ feet. The loch was surveyed on August 22, 1902, when the elevation of the lake-surface was found to be 465·6 feet above sea-level; when visited by the officers of the Ordnance Survey on June 6, 1870, the elevation was 465·1 feet above the sea.

Loch Beannachan forms a simple basin, the contour-lines following approximately the outline of the loch, but approaching in each case

nearer to the western than to the eastern end. There is a large wooded island at the entrance of the inflowing river at the west end, and a small island near the exit of the outflowing river at the opposite end. The slope off-shore is in some places very steep, especially at certain points along the southern shore, and at the position of the deepest sounding the slope is steeper off the southern than off the northern shore, as is shown in the cross section C–D on the map. The longitudinal section A–B shows the gradual slope towards the two ends, with quite a flat-bottomed character in the deeper water, which is also indicated by the larger area between 100 and 150 feet than between 50 and 100 feet, as given in the following table:—

Feet.	Acres.	Per cent.
0 to 50	113 ...	42·3
50 „ 100	67 ...	25·0
100 „ 150	72 ...	27·2
Over 150	15 ...	5·5
	267	100·0

Temperature Observations.—A series of temperatures taken in the deepest part of the loch at 4.15 p.m. on August 22, 1902, gave the following results:—

Surface	55°·0 Fahr.
10 feet	55°·0 „
20 „	54°·8 „
30 „	53°·0 „
40 „	52° 9 „
50 „	52°·0 „
60 „	50°·5 „
75 „	46° 9 „
100 „	46°·1 „
170 „	46°·0 „

This series shows a range of temperature from surface to bottom amounting to 9° Fahr. The upper 20 feet of water was practically of uniform temperature, followed by a fall of 1°·8 between 20 and 30 feet, but the greatest fall observed was one of 3°·6 between 60 and 75 feet.

Loch Achilty (see Plate V.).—Loch Achilty is a small but deep loch in Torrachilty Wood, near Strathpeffer, containing char. In outline it is somewhat elliptical, with the long axis trending north-east and south-west. It is about 1500 yards in length, by 700 yards in maximum breadth, the mean breadth being 450 yards. Its waters cover an area of about 147 acres (or nearly a quarter of a square mile), and it drains an area exceeding 2 square miles. The maximum depth of 119 feet was observed about 250 yards from the western shore. The volume of water is estimated at 332 million cubic feet, and the mean depth at 51¾ feet. The floor of Loch Achilty is irregular. The 10-feet

contour follows approximately the outline of the loch, in many places approaching very close to the shore, but the deeper contours are all sinuous in character, and there are two small basins exceeding 100 feet in depth, the larger and deeper towards the western shore, and the smaller, based on a sounding of 112 feet, near the centre of the loch. Deep soundings were recorded in some positions near shore, while in other positions comparatively shallow soundings were taken some distance off shore. A longitudinal section along the axis of maximum depth is shown in section C–D on the map. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	41 ...	28·0
25 „ 50	28 ...	19·2
50 „ 75	39 ...	26·2
75 „ 100	30 ...	20·2
Over 100	9 ...	6·4
	147	100·0

This table shows a smaller area, and therefore an average steeper slope, between 25 and 50 feet, than in the deeper water. The loch was surveyed on August 20 and 21, 1902, when the elevation of the lake-surface was found to be 98·5 feet above the sea, so that the 100-feet contours show approximately the two small portions of the lake-floor which lie below the level of the sea.

Temperature Observations.—In the following table are given the results of three series of temperatures taken in Loch Achilty by Mr. Clark in 1901, along with a series taken in 1902 at the time of the survey:—

Depth in feet.	August 11, 1901 (R. M. Clark).	August 23, 1901 (R. M. Clark).	September 2, 1901 (R. M. Clark).	August 21, 1902 (Lake Survey).
	° Fahr.	° Fahr.	° Fahr.	° Fahr.
0	63·5	61·9	—	58·4
5	—	61·9	—	—
10	62·0	—	—	58·1
20	—	61·5	—	57·6
25	59·4	57·3	—	56·0
30	—	52·0	—	54·9
35	—	46·0	—	50·9
40	46·0	44·0	45·9	48·0
50	—	43·2	43·2	46·0
55	—	42·8	42·8	—
60	—	42·8	42·8	—
70	42·3	—	—	—
100	—	—	—	44·9

These serials indicate a most remarkable range of temperature—a range amounting to 21°·2 from the surface to a depth of 70 feet on August 11, 1901, and 19°·1 from the surface to a depth of 60 feet on

August 23, 1901; the range observed in 1902 was much less, viz. 13°·5 from the surface to a depth of 100 feet. Down to a depth of 25 feet the readings were higher in 1901 than in 1902, but beyond that depth the temperature was lower in 1901 than in 1902. The greatest fall of temperature was observed between the depths of 25 and 40 feet in both seasons, but the decrease of temperature within this interval of 15 feet amounted in 1901 to 13°·3 and 13°·4, while in 1902 it amounted only to 8°. The only observations that may be compared, as regards range of temperature, with these in Loch Achilty, were taken in Loch Monzievaird * in the Tay basin on June 8, 1903, when the range amounted to 20°·6 from the surface to a depth of 36 feet, and when a fall of temperature equal to 1°·5 per foot of depth was observed between 5 and 15 feet. The temperature conditions observed in Loch Achilty (as well as in Loch Monzievaird) may probably be ascribed to (1) the comparatively great depth, (2) the comparatively small drainage area, and (3) the sheltered position, the thickly wooded shores tending to temper the force of the winds blowing across the surface of the water. Mention may here be made also of the large range of temperature observed in the little Loch Dubh † in the nan Uamh basin on July 12, 1902, when the range amounted to 15½° from the surface to a depth of 100 feet; it is possible that under favourable weather conditions, and later in the season, the range of temperature in the waters of Loch Dubh may equal that observed in Loch Achilty.

Loch Garve (see Plate V.).—Loch Garve lies about 5 miles to the west of Strathpeffer, and to the south-west of the mighty Ben Wyvis (3295 feet). It receives the drainage from a large tract of mountainous country lying to the north and north-west. The body of the loch trends in a north-west and south-east direction, and is somewhat elliptical in outline, while the south-eastern end takes a slight bend to the north-east. The loch is over 1½ miles in extreme length, with a maximum breadth of half a mile, the mean breadth being over one-third of a mile. Its waters cover an area of about 380 acres, or over half a square mile, and it drains an area of 114 square miles—an area nearly two hundred times greater than that of the loch. The maximum depth of 105 feet was observed near the centre of the loch, but towards the south-western shore. The volume of water is estimated at 721 million cubic feet, and the mean depth at 43½ feet. The loch forms on the whole a simple basin, with a slight shoaling at the position of the bend in the outline of the loch. The 10-feet and 25-feet contours extend from end to end of the loch, following approximately the form of the shore-line; but the deeper contours are confined to

* See *Geographical Journal*, vol. **23**, p. 45; and *Scottish Geographical Magazine*, vol. **20**, p. 27, January, 1904.

† See *Geographical Journal*, vol. **25**, p. 281, March, 1905.

the wide body of the loch, the 50-feet basin being nearly a mile, and the 100-feet basin nearly a quarter of a mile, in length. Off the central portions of both the north-eastern and south-western shores the slope is moderately steep. The longitudinal section A–B on the map is taken along the axis of maximum depth, and shows the slight deepening of the water near the south-eastern end. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.				Acres.		Per cent.
0 to 25	...	...	...	131	...	34·5
25 to 50	...	...	...	104	...	27·4
50 to 75	...	...	...	72	...	18·8
75 to 100	...	...	...	64	...	16·9
Over 100	...	...	...	9	...	2·4
				380		100·0

From this table it will be seen that nearly two-thirds of the entire lake-floor is covered by less than 50 feet of water. Loch Garve was surveyed on August 15, 1902, when the elevation of the lake-surface was found to be 218·8 feet above the sea; when visited by the Ordnance Survey officers on August 15, 1871, the elevation was 219·6 feet above sea-level.

Temperature Observations.—The following table gives the results of observations made in Loch Garve in 1901 by Mr. Clark, and in 1902 by the Lake Survey:—

Depth in feet.	August 18, 1901 (E. M. Clark).	August 15, 1902.
	° Fahr.	° Fahr.
0	59·3	54·2
5	59·3	—
10	59·3	54·2
15	59·2	—
20	59·2	—
30	—	54·2
40	59·0	—
50	—	54·0
55	55·4	—
60	54·2	—
70	51·0	53·5
85	49·0	—

The 1901 observations show a range exceeding 10°, whereas the 1902 observations show that the temperature was practically uniform from surface to bottom, which may perhaps be ascribed to the influence of the strong winds prevailing at the time of the survey, causing a thorough circulation in the whole body of water.

Loch Kinellan (see Plate V.).—Loch Kinellan is a small shallow loch near Strathpeffer, which was surveyed on August 23, 1902. The

elevation of the lake-surface was not determined by levelling, but from the Ordnance Survey contours it is evidently nearly 500 feet above the sea. It trends north-east and south-west, widest in the south-western portion, and with a large wooded island near the centre. Weeds abound along the western and south-western shores, and also between the island and the eastern shore. It is one-third of a mile in length, and its waters cover an area of about 15 acres. Soundings of 10 and 11 feet were taken to the north-east of the island, but the deepest part lies to the south-west, the maximum depth of 16 feet having been observed about midway between the island and the southern shore; 73 per cent. of the lake-floor is covered by less than 10 feet of water. The volume of water is estimated at 5 million cubic feet, and the mean depth at over 7 feet. The temperature of the surface water at 12.30 p.m. on the date of the survey was 58°·7 Fahr., and at a depth of 14 feet 58°·3.

Loch Ussie (see Plate V.).—Loch Ussie (or Usie) is about a mile from Strathpeffer and 3 miles from Dingwall. It is irregular and subcircular in outline, with a maximum diameter from north-east to south-west of nearly a mile. There is one large island with a heronry upon it, and several smaller ones, and weeds are abundant in some of the bays and in the vicinity of the islands. It was surveyed on August 29, 1902, but the elevation above the sea was not determined by levelling; when visited by the Ordnance Survey officers on September 7, 1870, the elevation was 418·9 feet above sea-level. Its waters cover an area of nearly 200 acres, or less than one-third of a square mile, and it drains an area of nearly 4 square miles. The loch is on the whole very shallow, with a deep hole in the north-eastern part of the loch, in which two soundings of 35 feet were taken; except for a neighbouring sounding of 22 feet, the remainder of the lake-floor is covered by less than 20 feet of water, and all the western and southern parts of the loch are less than 10 feet in depth. The volume of water is estimated at 68 million cubic feet, and the mean depth at 8 feet. Only 22 per cent. of the lake-bottom is covered by more than 10 feet of water, and only 2 per cent. by more than 25 feet of water. At 5.15 p.m. on the date of the survey the surface temperature was 59°·3 Fahr., and a reading at 27 feet gave 59°·0.

Loch Glass (see Plate VI.).—Loch Glass is one of the larger and more important lochs within the drainage basin of the Cromarty firth, and it exceeds in depth all the other lochs of the basin. It lies in a mountainous district to the north of Strathpeffer, with Ben Wyvis and other peaks exceeding 3000 feet in height to the south-west, and lesser mountains to west, north, and north-east. It trends in a north-west and south-east direction, but with a slight bend in the outline, causing

it to appear somewhat crescent-shaped. It is 4 miles in length, with a maximum width near the centre of two-thirds of a mile, narrowing gradually towards the south-east end, where the river Glass flows out, the mean breadth being nearly half a mile. Its waters cover an area of nearly 2 square miles, and it drains an area exceeding 25 square miles. The maximum depth of 365 feet was observed nearer the north-west than the south-east end, and towards the north-eastern shore. The volume of water is estimated at 8265 millions of cubic feet, and the mean depth at 159 feet. It was surveyed on August 26 and 27, 1902, but the elevation of the lake-surface above the sea was not determined by levelling; when visited by the Ordnance Survey officers on September 1, 1868, the elevation was found to be 712·9 feet above sea-level. Loch Glass forms a simple basin, with very few minor undulations of the lake-floor. The deeper water lies towards the north-west end, and the contour-lines all enclose continuous areas. The 100-feet basin is $2\frac{3}{4}$ miles in length, approaching close to the north-west end, but distant nearly a mile from the south-east end. The 200-feet basin is nearly 2 miles, and the 300-feet basin over a mile, in length, being distant respectively $1\frac{1}{2}$ and 2 miles from the south-east end. The soundings indicate here and there slight irregularities on the lake-floor, and sometimes in very deep water. One of these gives rise to a curious sinuosity in the 300-feet contour-line off the south-western shore, and the sounding immediately to the south-west of the maximum depth of 365 feet indicates a shoaling of the water to 346 feet, followed by a deepening of the water to 354 feet, which is well brought out in the cross-section C–D on the map. The longitudinal section A–B shows the rapid deepening of the water on proceeding from the north-west end, and the gradual shoaling of the water on approaching the opposite end of the loch. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows :—

Feet.				Acres.		Per cent.
0 to 100	...	...	...	454	...	38·1
100 „ 200	...	...	...	309	...	25·8
200 „ 300	...	...	...	269	...	22·6
Over 300	...	...	...	161	...	13·5
				1193		100·0

The comparatively large area of the lake-floor covered by more than 300 feet of water indicates the flat-bottomed character of the deeper part of the loch, and this is also shown by the comparatively great width of the 200-feet and 300-feet basins, and is well seen in the cross-section C-D.

Temperature Observations.—An interesting series of temperatures was taken in the deepest part of Loch Glass at 6 p.m. on August 27, 1902, as given in the following table :—

Surface	...	...	...	...	...	...	...	54°·7	Fahr.
50	„	...	...	...	..	...	...	...	51°·7	„
100	„	...	...	...	...	...	...	...	46°·2	„
150	„	...	...	...	...	...	...	...	43°·5	„
250	„	...	...	...	...	...	...	...	42°·5	„
350	„	...	...	...	...	...	...	...	42°·3	„

This series shows a range of temperature from surface to bottom amounting to 12°·4, the greatest fall being one of 5°·5 between 50 and 100 feet. The temperatures taken in Loch Achilty six days earlier gave a higher temperature from the surface down to 30 feet than was observed at the surface of Loch Glass, but a lower temperature at 50 feet and 100 feet, the differences being respectively 5°·7 and 1°·3.

Loch Morie (see Plate VII.).—Loch Morie (or Muilie) lies less than 2 miles to the north of Loch Glass, with the crests of Meall Beag (2121 feet) and Meall Mor (2419 feet) rising between them. It is an important and deep loch, containing trout, but the fishing is preserved. Loch a' Chaoruinn and Loch Magharaidh, which flow into it, could not be sounded for lack of boats. It trends in a north-west and south-east direction, with a slight sinuosity in its outline. It is $2\frac{1}{3}$ miles in length, with a maximum breadth of over half a mile. Its waters cover an area of nearly a square mile, and it receives the drainage from a large tract of the mountainous country to the north-west, the area of which exceeds 35 square miles. The maximum depth of 270 feet was observed in the central part of the loch, but nearer the south-western than the north-eastern shore, as will be seen in the cross-section C–D on the map, which is taken at the position of the deepest sounding. The volume of water is estimated at 3201 millions of cubic feet, and the mean depth at 125 feet. Loch Morie was surveyed on August 28, 1902, when the water-surface was found to be 621·6 feet above the sea; when visited by the Ordnance Survey officers on September 28, 1868, the elevation was 622 feet. The loch forms a simple basin, the contour-lines all enclosing continuous areas. The shallower contours follow approximately the outline of the loch, but the deeper ones bend in their central portions towards the south-western shore. The 100-feet basin is over $1\frac{1}{2}$ miles, and the 200-feet basin is over a mile, in length. The slope of the bottom is in some places very steep—for instance, off the south-western shore towards the north-west end, where a sounding of 75 feet was taken about 60 feet from shore, and one of 124 feet about 120 feet from shore, showing in each case a gradient exceeding 1 in 1. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows :—

Feet.				Acres.		Per cent.
0 to 50	...	...	...	148	...	25·2
50 „ 100	...	...	...	92	...	15·8
100 „ 150	...	...	...	104	...	17·7
150 „ 200	...	...	...	113	...	19·2
200 „ 250	...	...	...	106	...	18·0
Over 250	...	...	...	24	...	4·1
				587		100·0

It will be observed that the area between 50 and 100 feet, and to a less extent that between 100 and 150 feet, are smaller than the shallower and deeper zones, indicating an average slope steeper between 50 and 150 feet than elsewhere. The temperature of the surface water was 54°·0 Fahr. on the date of the survey, but serial temperatures could not be attempted on account of the gale that was blowing.

Loch Eye (see Plate VIII.).—Loch Eye is a rather large but very shallow loch, about 3 miles from Tain and a mile from Inver bay, an inlet of the Dornoch firth. It was surveyed on September 26, 1902, when the surface of the water was found to stand 47·8 feet above the sea; on December 24, 1867, the Ordnance Survey officers found the elevation to be 50·7 feet above sea-level, or 3 feet higher than in 1902. The loch is 1¾ miles in length, with a maximum width of nearly two-thirds of a mile, and covers an area of over 210 acres, or one-third of a square mile. The maximum depth is 7 feet, and the mean depth 4 feet, the volume of water being estimated at 37 million cubic feet. The loch is a flat-bottomed shallow basin, 45 per cent. of the lake-floor being covered by more than 5 feet of water. The temperature of the surface water on the date of the survey was 54°·8 Fahr., while a reading at the bottom in 7 feet gave 55°·0.

The particulars regarding the lochs dealt with in this paper are collected together in the table on p. 62 for convenience of reference and comparison.

From this table it will be seen that in the sixteen lochs under consideration, which cover an area of over 11½ square miles, nearly 2200 soundings were taken, or an average of 188 soundings per square mile of surface. The aggregate volume of water contained in the lochs is estimated at nearly 30,000 millions of cubic feet, and the area draining into them is over 366 square miles, or thirty-one and a half times the area of the lochs.

SUMMARY TABLE.

Giving Details concerning the Lochs described in this Paper.

Loch.	Height above sea. Feet.	Number of soundings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in million cubic feet.	Area in square miles.	Drainage area.	
				Max.	Mean.		Max. Feet.	Mean Feet.	Mean per cent. of max.	Max.	Mean.			Total in square miles.	Ratio to area of loch.
Crann	513·7	26	0·22	0·17	0·10	45·5	17	6·8	39·9	68	171	4	0·02	11·52	576·0
a' Chroisg	508·4	183	3·47	0·42	0·29	8·4	168	73·8	43·9	109	248	2057	1·00	19·15	19·2
South Loch Gown ...	524·4	69	0·55	0·30	0·16	29·1	52	15·9	30·5	56	183	38	0·09	13·10	150·6
North „ „ ...	522·1	72	0·57	0·19	0·13	22·8	17	6·9	40·4	177	438	14	0·07	14·16	191·3
Achanalt	365·1	122	0·84	0·67	0·30	35·7	9	4·5	50·0	493	986	31	0·25	72·63	290·5
a' Chuilinn	360·8	125	1·35	0·31	0·13	9·6	43	10·2	23·8	166	697	50	0·18	74·32	412·9
Fannich	821·9	383	6·92	0·79	0·52	7·5	282	108·8	38·6	130	336	10,920	3·60	35·69	9·9
Luichart	249·8	255	5·05	0·90	0·35	6·9	164	66·8	40·8	163	399	3288	1·76	149·45	84·9
Beannachan	465·6	91	1·85	0·35	0·23	12·4	176	70·4	40·0	55	139	819	0·42	30·12	71·7
Achilty	98·5	131	0·87	0·40	0·26	29·9	119	51·8	43·5	39	89	332	0·23	2·11	9·2
Garve	218·8	137	1·54	0·53	0·39	25·3	105	43·6	41·5	77	186	721	0·59	113·97	193·2
Kinellan	—	37	0·33	0·12	0·07	21·2	16	7·1	44·6	109	244	5	0·02	0·90	45·0
Ussie	418·9 [7/9/70]	109	0·84	0·66	0·37	44·0	35	8·0	22·8	127	556	68	0·31	3·85	12·4
Glass	712·9 [1/9/68]	224	4·03	0·65	0·46	11·4	365	159·1	43·6	58	134	8265	1·86	25·35	13·6
Morie	621·6	126	2·30	0·60	0·40	17·3	270	125·2	46·4	45	97	3201	0·92	35·28	38·3
Eye	47·8	98	1·72	0·62	0·19	11·0	7	4·1	58·6	1294	2215	37	0·33	5·30	16·1
		2188										29,850	11·65	366·33 *	31·5

* The drainage areas of Lochs Crann, a' Chroisg, Gown, Achanalt, a' Chuilinn, and Fannich are included in that of Loch Luichart.

NOTES ON THE GEOLOGY OF THE CONON BASIN.

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The rock groups entering into the geological structure of the Conon basin and the area including Strath Glass and Strath Rusdale, north of Ben Wyvis, belong to the crystalline schists and the Old Red Sandstone. A line drawn from a point in Strath Rusdale above Ardross Castle, south-west by Eileneach in Strath Glass, Achterneed station, the Falls of Rogie, and across the Conon to Glen Orrin above Muirtown House, roughly marks the boundary between the metamorphic rocks to the west and the Old Red Sandstone bordering the Cromarty firth. It will thus be seen that the crystalline schists form not only the greater part of the basin, but also the highest and wildest territory.

From the researches of the Geological Survey, extending over the greater portion of the area under description, it would appear that the metamorphic rocks may be arranged in two divisions: (1) a group of acid, basic, and ultrabasic rocks, resembling certain types of Lewisian gneiss of pre-Torridonian age along the western seaboard of Sutherland and Ross; (2) the Moine series, representing altered sediments and including the main subdivisions, (*a*) granulitic quartz-schists or quartz biotite granulites, (*b*) flaky muscovite biotite schists or gneiss frequently garnetiferous, and passing into flaggy mica-schists (pelitic schists).

Though the group of rocks of Lewisian type comprise certain acid granulitic gneisses that closely resemble the quartzose members of the Moine series, yet their dominant feature is the alternation of acid and basic materials in the form of biotite and hornblende gneisses. With these are associated bands of garnet, amphibolite, and hornblende-schist that have been mapped for some distance both in the Fannich mountains, and near Scardroy, in the basin of the Meig. In some areas schists of ultra-basic type appear that represent original masses of peridotite. This group forms isolated areas or inliers in the midst of the Moine series, being regarded as older than the latter, and probably representing the floor or platform on which the members of the Moine series rest. It is significant that different bands of the so-called Lewisian gneisses in the Conon basin are in contact with the crystalline Moine schists of sedimentary origin, and that different subdivisions of the latter overlap the former.

These gneisses of Lewisian type appear at intervals, sometimes forming comparatively narrow zones, and, again, rather broad belts. On the north and west slopes of the Fannich mountains they have been traced for several miles, being there overlain and underlain by the flaky muscovite-biotite schists of the Moine series. Southwards between Strath Bran and the basin of the Meig, near Scardroy, there is a large development of them, where their relations to the Moine schists are well displayed. They likewise appear in Glen Orrin, and southwards towards Glen Strathfarrar, and eastwards near Loch Luichart.

With the exception of certain masses of foliated and unfoliated, intrusive, igneous rocks, the members of the Moine series occupy the rest of the area covered by the crystalline schists. Their lithological characters are comparatively uniform. The two main subdivisions, already indicated, graduate into each other in certain localities, thus forming an intermediate type between the highly quartzose granulitic schists on the one hand, and the flaky muscovite-biotite schists on the other. The members of the Moine series, which have the largest development and the widest distribution, consist of granulitic quartz-schists or quartz-biotite granulites, but the pelitic schists sometimes form the most elevated ground, as, for instance, on Sgùrr Mor

Fannich (3637 feet), the highest of the Fannich mountains.* The boundary-line between the two main subdivisions of the Moine series is highly involved, showing intricate rapid folding, frequently isoclinal, and pointing to intense reduplication of the strata. The most prominent belts of the garnetiferous muscovite-schists have a wide distribution in the basin of the Conon. For example, they appear in the Fannich mountains, and extend south-west by Ben Fionn and Loch Rosque to Moruisg, east of Glen Carron. They likewise appear in Glen Orrin and Glen Meig, and prominent bands have been traced more or less continuously from Strath Bran north-north-west by Aultguish and the hills west of Strath Vaich to Glen Beg and Glen Alladale, in the basin of Strath Carron. Still further east, this characteristic zone has been followed from Ben Wyvis across Strath Glass and Strath Rusdale to the hills near Fearn.

The constant reappearance, throughout the metamorphic area of the Conon basin, of the two main subdivisions of the Moine series suggests the repetition of these zones by folding. Indeed, such is the view adopted by the Geological Survey, and hence the actual thickness of this series may be much more limited than the persistent dip of the strata in one direction would lead us to suppose. The researches of the Survey indicate a probable order of succession in these schists which obtains in the tract between Ben Wyvis and Ben Dearg, and between Garve and the Carron that flows into the Dornoch Firth.

In the flaky muscovite biotite schists, and in the quartzose granulites, bands of garnet amphibolite and hornblende schists occur, which have a wide distribution and are characteristic of certain horizons.

Reference must now be made to the foliated granite, intrusive in the Moine series, which is one of the most interesting features in the geology of the Conon basin. Its boundaries are of prime importance, because the distribution of the boulders supplies valuable evidence regarding the direction of the ice-flow during the glacial period. There are two important masses of these older intrusive rocks. The larger one extends from Carn nan Aigheinn, near the head of Strath Rannoch, north-east by Carn Chuinneag to Cnoc an Liath-bhaid beyond Strath Rusdale, and measures about 12 miles in length and about 5 miles in breadth. The smaller one stretches from the hills above Loch Luichart north-east by Inchbae to Carn More east of Strath Rannoch, being about 5 miles long and less than 3 miles broad. Again, on the north shore of Loch Luichart there are four outcrops of foliated granite, evidently belonging to the same set of intrusions. The Inchbae type of augen-gneiss or granite is well known, with large porphyritic crystals of orthoclase felspar oriented in a definite direction, enclosed in a granulitic ground-mass of quartz, felspar, and micas, together with crystals of garnet and sphene. This coarse porphyritic variety is largely developed in the Carn Chuinneag mass, where it is associated with foliated riebeckite granite or augen gneiss. Frequently the rock is fine grained, and merges into a finely crystalline schist.

Evidence has been obtained that these older granite masses with their basic modifications were intruded into the series of Moine sediments before they were converted into crystalline schists. A well-marked aureole of contact metamorphism accompanied this intrusion, which in places has been obscured by subsequent deformation. But at intervals round the margin the sediments are hornfelsed, and still show their original bedding-planes, while garnets and crystals of andalusite have been developed. It is further apparent that the granite masses and the Moine sediments have been subjected to a common series of dynamic stresses; for the planes

* The quartz-schists contain pebbly bands in places, thus clearly showing their derivative origin.

of schistosity in the granite are parallel to those in the Moine schists; indeed, in certain localities they pass, irrespective of the boundary-line, from the igneous to the altered sedimentary rocks.

On either side of the Sutors of Cromarty, and stretching southwards along the sea-cliff to Fortrose, there is a narrow belt of crystalline schists rising from underneath the Old Red Sandstone. They belong to the group of quartz-biotite granulites, and are associated with bands of amphibolite.

Newer granite masses are also represented in the area, as, for instance, on the hills north of Ardross Castle above Strath Rusdale, and in Glen Orrin west of Fairburn House. They resemble the normal types of the newer granite masses of the Highlands, and were erupted after the Moine schists had assumed their present crystalline character.

The strata of Old Red Sandstone age in the basin of the Cromarty firth are arranged in the form of a great syncline, whose axis runs in a north-north-east and south-south-west direction. The base of the series and the order of succession are admirably displayed on the sea-cliffs at Cromarty, and on the south-east shore of that firth as described long ago by Hugh Miller. The basal conglomerate is there overlain by the well-known fish-band, with calcareous nodules, graduating upwards into the coarse sandstones that form the centre of the basin. On the west side of the firth a similar sequence is observable. The basal conglomerate along the flanks of the hills is usually brought into conjunction with the crystalline schists by a fault, evidently of no great amount, for the unconformity is visible at certain localities. This horizon is surmounted by red sandstones and flagstones, calcareous and bituminous shales, and occasional intercalations of clays with limestone nodules, with fish remains. These are followed by an upper band of conglomerate, which is overlain by the coarse sandstones in the centre of the basin.

Various outliers of Old Red Sandstone, largely composed of conglomerate, and resting unconformably on the highly denuded platform of crystalline schists, occur some miles to the west of the main area of this formation in the Conon basin. Some of these are met with on the plateau between Loch Luichart and Aultguish. By far the largest and most important is that still further north in Strath Vaich, where an extremely coarse conglomerate, composed largely of blocks of the contiguous foliated granite, is found on the crest of Meall a' Ghrianain (2531 feet).

At the base of the sea-cliff formed by the crystalline schists and Old Red Sandstone of the Black Isle and the North Sutor, there are small patches of Oolitic rocks which have only a limited development. They occur on the beach below high-water mark at Eathie and at Port-an-Righ and Cadh-an-Righ near Sandwick. By means of the great fault that traverses the line of the Caledonian canal, and is continued north-east along the shore of the Black Isle, these Secondary strata have been let down against the older rocks.

Regarding the lines of displacement in the Conon basin, one of the most important is that just referred to, which skirts the base of the Black Isle, and is prolonged north-east to Tarbat Ness, whereby this straight feature has been determined. The great fault that traverses Loch Maree and Glen Docherty passes south-east by Ledgown, thence across the watershed by Carn Chaorainn to Loch Beannachan in the basin of the Meig. Another powerful dislocation, nearly at right angles to the course of the Loch Maree fault, has determined the north-north-east direction of the Meig valley between Inbhir-Chaorainn and Milton of Strathconon, and stretches south-west up Glen Chaorainn in the direction of Loch Monar, and north-north-east to the head of Loch Luichart.

During the period of extreme glaciation it would appear that the ice-shed lay some distance to the east of the existing watershed in part of the Conon basin, for

boulders of foliated granite or augen gneiss, from one or other of the masses near Inchbae, have been carried westward into the valley of Loch Broom, to Inverlael, and nearly as far as Ullapool. Their distribution in an eastward direction is no less remarkable, for they have been traced as erratics across the Black Isle and the Moray firth to the plain of Moray and the low grounds of Banffshire. The boulder clay of the north part of the Black Isle contains numerous blocks of this well-known rock, which were probably dispersed during the greatest extension of the ice. Such evidence is in harmony with that obtained in the Assynt district, where blocks of the eastern schists have been carried from the plateau of the Moine schists, east of the existing watershed, to higher elevations to the west, formed of Cambrian strata. In view of these facts, it seems probable that during one stage of the glacial period the Conon basin must have been buried under an ice-sheet that overtopped the highest hills, the movement of which was largely independent of the physical features of the region.

During the period of confluent glaciers that ensued, the great mountain groups formed more or less independent centres of dispersion. Indeed, many of the striæ, the disposition of the moraines, and the distribution of the carried blocks furnish evidence relating to this phase of glaciation. In the Fannich mountains—a range running east and west for about 7 miles, and whose main peaks rise above 3000 feet—ice-markings were found on the southern slopes at elevations between 2250 and 2500 feet trending south-south-east. Striæ pointing in a similar direction occur at various points on the ridge between Loch Fannich and Strath Bran, thus showing that at one period the Fannich ice must have crossed that loch into the Bran valley. Again, during this later glaciation, ice crossed the watersheds from Glen Fhiodaig and from Strath Conon into the valley of the Bran, and after uniting with the glaciers from Fannich and the Blackwater, passed eastwards by the Conon valley towards the Black Isle. The striæ, trending about east-south-east, found on the tops of Meall na Speirag and Beinn Liath Beg at elevations of about 2000 feet, on the watershed between the Black Water and the streams flowing into Loch Luichart, clearly show the development of the ice during this period.

Important evidence regarding the transport of materials during the time of the confluent glaciers is furnished by the distribution of boulders of foliated granite and Old Red Sandstone on the slopes of Ben Wyvis. These have been carried from the west or west-north-west, and have been traced up to a height of 2400 feet on Carn Gorm and Little Wyvis, while their upper limit on Ben Wyvis itself is 2300 feet. It is further apparent that the ice moved through the pass between Little Wyvis and An Cabar, and streamed down the valley of Loch Glass north of Ben Wyvis. Still further north in Kildermorie Forest and Strath Rusdale, the direction of the ice-flow was south of east, as proved by the striæ, and the transport of boulders of foliated granite or augen gneiss. From the period of confluent glaciers to the time of their disappearance in the upland glens, the various stages of retrocession are represented by the moraines.

Loch Fannich.—The soundings clearly show that this lake gradually deepens towards the eastern portion, the deepest sounding, 282 feet, being situated about a mile above the outlet. The hill-slopes on both sides of the loch for considerable distances are covered with morainic drift, save near the outlet, where there is a prominent barrier of rock. At the latter point the southern spur of An Coileachan approaches the northern margin of the lake, and is prolonged on the south side in An Cabhar and Carn na Beiste. Along the eastern side of this ridge, the quartzose granulites and muscovite-biotite schists are isoclinally folded on vertical axes striking north and south—that is, at right angles to the course of the lower part of the loch. At the outlet, and for a mile below that point, the Grudie river

flows on alluvial deposits, these materials having been largely contributed by side streams, and especially by Allt a' Choin Idir, draining from the north. Beyond the alluvium, at the 800-feet level, the Moine schists are exposed in the bed of the river and on the hill-slopes, and there is here no indication of a preglacial river-channel filled with drift. The surface of Loch Fannich is 822 feet above Ordnance datum, so that the depth of the rock basin below the rocky barrier, visible about a mile beyond the outlet, is 260 feet.

Loch Luichart.—This lake is a true rock basin lying among the crystalline schists, with a barrier formed of these materials at its outlet. Where the stream issues from the loch, it runs through a narrow gorge of rock and over successive waterfalls. In this sheet of water there are three basins, of which the most westerly is the most important, its greatest depth being 164 feet. The surface of the lake is 250 feet above Ordnance datum line. The axis of the upper part of the loch coincides with the strike of the crystalline schists, while that of the lower is obliquely across it. It is interesting to note that the deepest basin has been excavated out of the flaky muscovite-biotite schists, while the shallow part about the middle of the loch north of Creag Mhor corresponds with a belt of highly siliceous Moine schist folded over a core of gneiss of Lewisian type. The head of the lake nearly coincides with the Strath Conon fault already referred to, which crosses the lake in a north-north-east direction, and has there produced considerable brecciation of the strata. Only a small part has been silted up at the western end by the alluvial material brought down by the Bran and the Grudie.

Loch a' Chroisg and Loch Crann.—The former lake is evidently a rock basin, for, though at its outlet it flows over alluvial deposits that mark the site of an old lake, the rocky barrier appears about 2 miles east of Achnasheen, where the 400-feet contour-line crosses the Bran river. The surface of the loch is 508 feet above Ordnance datum, and the deepest sounding is 168 feet, so that the depth of the loch below the rocky barrier beyond Achnasheen is 60 feet. Loch Crann has been separated from Loch a' Chroisg by a cone of alluvium brought down by the streams on both sides of the valley at that point.

Loch Achanalt and Loch a' Chuilinn represent the remains of a lake which once extended for 4 miles up the valley to Dosmuckeran, the level of which has been lowered by the Bran. The materials cut through during this process of denudation consisted of moraine matter, but the river has now reached the solid rock. The terraces round Loch Achanalt and Loch a' Chuilinn rise to a height of 20 feet above the surface of these sheets of water. The deepest sounding in the former is 9 feet, and in the latter 43 feet. While Loch Achanalt is being rapidly silted up by alluvial detritus, Loch a' Chuilinn preserves its character of a rock basin. At its outlet the water flows over an ice-moulded surface of granulitic quartzose schist. The strike of the strata is nearly parallel with the long axis of the loch.

Loch Beannachan.—As already indicated, this lake lies along the line of the powerful fault that has been traced in a south-east direction from Loch Maree and Glen Docherty.

Loch Garve is evidently the remnant of a much larger sheet of water that formerly extended from Little Garve down to the Falls of Rogie—a distance of about 4 miles. The former level of the lake has been lowered by the erosion of the drift deposits and the cutting of the rock gorge at the Falls of Rogie. The surface of the present loch is 220 feet above Ordnance datum line, and the deepest sounding is 105 feet. The 200-feet contour-line crosses the stream at these waterfalls. Hence, on the assumption that the Moine schists and epidiorite sills exposed at the latter locality formed the original rocky barrier of the lake, the depth of water below this level in Loch Garve is still 84 feet.

Loch Achilty.—Though this lake is small, its extreme depth (119 feet) is remarkable. There is no proof that it occupies a rock basin, but it is not improbable that such may partly be the case. Towards the east it has been filled in by the delta gravels of the Black Water, and on the other side by those of the Conon at the time of the formation of the 100-feet beach.

Loch Ussie is a shallow basin, 35 feet in depth, resting in drift; and *Loch Kinellan* appears to be banked by superficial deposits at the west end, while at its eastern margin the bituminous shales of the Old Red Sandstone are exposed. Its greatest depth is only 16 feet.

Loch Morie is obliquely traversed by a line of fault, with a downthrow towards the south-west, that branches westwards in the upper part of the basin. Each branch shifts the outcrop of the zone of altered strata in contact with the mass of foliated granite already referred to. The stream issuing from the lake flows over a rocky barrier, but it is possible that there may have been a former outlet now concealed by drift.

Loch Glass.—Round the north-east margin there are traces of terraces between Culzie Lodge and the foot of the lake. No rocky barrier appears till the Falls of Eillenach are reached, where the stream flows over a mass of conglomerate of Old Red Sandstone age at an elevation of about 680 feet. As the surface of the loch is 713 feet above Ordnance datum line, and the deepest sounding is 365 feet, it follows that the depth of water in Loch Glass below the level of the barrier at the Falls of Eillenach is 332 feet.

Loch Eye lies on the stratified deposits of the 100-feet beach.

NOTES ON THE BIOLOGY OF THE LOCHS IN THE CONON BASIN.

By JAMES MURRAY.

The lochs dealt with in this paper, with the exception of Loch Eye, which will be separately noticed, have the plankton of a very uniform character. The fauna includes only those species which are common to the whole country, and calls for little detailed notice. The most important feature in it is the total absence of all those species of *Diaptomus* (*D. wierzejskii, D. laticeps, D. laciniatus*), which are common in the districts to the north and south of the Conon valley. This valley, extending nearly across Scotland, forms a line of interruption in the distribution of those species, a line completed towards the west by Lochs Maree, Dhughaill, and Sgamhain, all of similar character. Any slight peculiarity in the fauna will be noted under the name of each loch.

In contradistinction to the absence of western species in the fauna of these lochs, is the occurrence in the flora of several Desmids of the western type. These western Desmids, though less numerous than in districts both to the north and south, are in most of the lochs.

Loch Gown, North and South.—These very shallow basins had an admixture of littoral species in the plankton, and the numerous Desmids included both pelagic and bog species.

Loch a' Chroisg.—The only peculiarities of this loch were the abundance of algæ and of the smaller pelagic animals, such as Rotifera and Protozoa. *Floscularia pelagica*, Rousselet, was abundant.

Loch Achanalt.—Owing to its shallow weedy character, littoral species were more numerous than pelagic ones. A species of *Gammarus* was of a bright slaty blue colour. *Ophridium* was abundant on the weeds.

Loch a' Chuilinn.—Among the Rotifera observed were *Euchlanis lyra, E.*

dilatata, and *Pleurosmra truncatum*. The Desmid *Staurastrum arctiscon* was frequent.

Loch Fannich.—As in most of our largest lakes, there were skeletons of *Clathrulina elegans* floating in the water. Although this is not a true plankton organism (it lives attached by a stalk to plants), the skeletons have seldom or never been observed during the Lake Survey work except in large lakes, while it has rarely been seen living at the margins of those lakes. The lightness of the skeletons, enabling them to float on fresh water, may serve for the distribution of the species, and small cysts are commonly seen in them. Granting this, their absence from smaller lakes is still unexplained. The only suggestion I can offer is that the lower specific gravity, resulting from the higher temperature of smaller lakes, may prevent the floating of the skeletons, or that the higher temperature may lead to a more rapid decomposition of the material of which they are composed, and so prevent their accumulation in the water.

Loch Garve.—There was nothing peculiar in the plankton, except the apparent absence of Desmids.

Loch Luichart.—In contrast with the neighbouring Loch Garve, Desmids were here abundant, and other algæ were also numerous.

Loch Achilty.—Desmids were numerous, including, among species of the western type, *Staurastrum arctiscon*, and *S. jaculiferum*.

Loch Kinellan.—*Ceratium hirundinella* was very abundant, of a form with long divergent middle horns. There were also observed *Volvox globator*, *Asterionella* with very short rays, a species of *Ceriodaphnia*, and a few larvæ of *Corethra*.

Loch Ussie.—*Ceratium hirundinella*, of the same form as in Loch Kinellan, was the most abundant organism. This was the only loch in the district in which *Latona setifera* was seen.

Lochs Glass and *Morie* have no peculiarity worthy of remark, except the much greater abundance of algæ in Loch Glass.

Loch Eye.—This loch, which is only considered along with the Conon lochs as a matter of convenience, really approximates biologically to the lochs of the Shin basin, and of Sutherland generally. It is remarkable for the abundance of *Diaptomus wierzejskii*, this being the most southern locality on the mainland where the type of the species has been observed by the Lake Survey, though it extends much further south in the Outer Hebrides, where Dr. Scott got it in Barra. The Rotifer *Triarthra longiseta* was also abundant.

NOTES OF A LAND JOURNEY FROM FU-CHAU TO KIU-KIANG.*

By Major A. B. HAMILTON.

In the autumn of 1902, in company with Major the Hon. H. W. Trefusis, Scots Guards, I made the land journey between these two treaty ports. We left Fu-chau on the morning of September 25, in one of the small trading boats that navigate the upper waters of the Min river.

The first 70 miles of the river Min above Fu-chau are probably well known to many readers of the *Journal*. A broad stream picturesquely winding between hills, the lower slopes of these hills being

* Map, p. 128.

fringed with orchards or cultivated in terraces, here and there a group of houses occasionally increasing to the size of a village. It is justly celebrated for its scenery. Numerous large timber-rafts were floating down on its smooth surface, many bearing the Japanese flag, an outward sign of the special interest that Japan is taking in developing the Fu-kien province.

Sui-kau, a straggling village at the head of steam-launch navigation, was reached on the morning of the third day, and Yeng-ping, a prefectorial city, two days later. The city wall was broken and grass-grown, the streets narrow and uneven; it did not look very prosperous.

A few miles above Yeng-ping the river narrowed between shelving rocks, and for a hundred yards rushed down in broken water through a channel barely 20 yards wide. A day or two further on the navigation again became difficult, the stream winding through a labyrinth of low rocks. Tea was being more plentifully grown in this neighbourhood than in any other we saw; but even here it was but sparsely cultivated, rice was still the principal crop. The upper slopes of the hills were a dense mass of undergrowth, principally bamboo-grass. On the sixth day out we reached Kien-ning, another prefectorial town, nothing much to differentiate it from any other except its position. The general aspect of the country as we got further inland grew more open, and the river as a rule flowed silently along in a broad and shallow channel. Just before reaching Kien-yang, however, the river-bed was rocky and contracted, and in the only possible channel the water fell almost perpendicularly for a foot, and the rocks and islands in the stream made tracking very difficult.

Kien-yang stands picturesquely at the junction of a considerable affluent with the river Min. This tributary is spanned by a fine bridge, the abutment and piers of stone and the upper structure of timber on the cantilever principle. It was the only bridge of any size we had seen since we left Fu-chau, and, strange to say, it was particularly clean. We poled and tracked up-stream for an hour after passing Kien-yang with some difficulty, as we continually grounded. So we returned to the city, interviewed the Tao'tai, who received us with the usual ceremony and promised coolies for our outward journey next morning. We were evidently considered very strange beings in our European clothes; wherever we were seen there a crowd quickly gathered to stare at us. They were most inquisitive, but not disrespectful. Our path that morning took us along the right bank of the river, sometimes skirting it closely and sometimes passing across low disintegrated granite hills, and on the following evening we reached the town of Chung-an. On the following day our march was a gradual ascent up a picturesque valley. The road, paved as usual, was very slippery, its granite and porphyry boulders were almost polished by the traffic. We passed a number of pigs; most of them

THE MIN JUST ABOVE SUI KAU.

THE MIN RIVER LEAVING YENG-PING.

were being carried, but some were being driven with grass shoes on their feet. We reached the summit of the pass by midday of October 8. The view in both directions was very fine. An arched gateway with a small fort on one side guarded the highway, as it passed from the province of Fu-kien to that of Kiang-si; but, like all else we saw, it was in ruins.

There was a good deal of traffic on the road: wheelbarrows, the most unsuitable conveyance, one would think, for a stepped pathway, were being laboriously lifted up. Ducks in thousands were being carried over the Bohea hills, to feed in the still irrigated fields of the Fu-kien province. By nightfall we had almost dropped to the plain-level, and were again in the middle of rice-fields. The following afternoon we reached the city of Yuan-shan, and spent a good number of hours in paying and receiving complimentary visits. Next day our path took us through fields and market gardens, with homesteads dotted about. We reached the small town of Ho-ko early in the afternoon. We had reached a navigable waterway, and hired a boat from this town to take us to Sui-fung, six days' journey down-stream.

The river—the Kin-kiang—had a very slight current and a very sinuous course. The country on either bank was undulating, and here and there a sandstone ridge ended in a bluff where it abutted on the river. There was not much cargo-traffic on the river, nor many people to be seen along its banks. The soil, as a rule, was light, and such cultivation as there was was poor.

At Sui-fung we had evidently nearly reached the level of the Poyang lake, for the water was almost still and of a greenish hue. The country on either hand became less and less cultivated, till, shortly after leaving Sui-fung, the channel was simply marked by steep mud-banks some 10 feet high, topped by high grass and reeds that gradually slope downwards into lagoons, with rising ground beyond in the hazy distance. As we journeyed on, the expanse of water increased, and on one of the last spots of dry ground the village of Kong-san appeared to stand on the verge of the lake; but we had not yet come to the lake proper, for a three hours' pull across a sheet of water and we again found ourselves in a maze of tortuous channels between low banks of coarse herbage. It was dark on the evening of October 17 when we turned out of a narrow channel into a much broader one, to find ourselves opposite a considerable town. For some time we were uncertain where we were. We were told that the place was called Kau-man or Poyang, but such a place was not marked on our maps. We subsequently identified it with the town of Jau-chau. We had now reached the edge of the Poyang lake. The following day we again changed our boat, and by nightfall had anchored near the last bit of dry land. Next morning we were under way before three, and, in the uncertain light of a moon veiled by clouds, we

BETWEEN KIEN-YANG AND CHUNG-AN.

ON THE LOWER WESTERN SLOPES OF THE BOHEA HILLS, LOOKING TOWARDS THE FU-KIEN PROVINCE.

headed for the open water. Nothing but a few distant shadows were to be seen, that proved on closer acquaintance to be islands, and towards the far east a very dim line, showing where the mainland lay. The darkness of the early morning hours, and the difficulty of getting a reliable idea of our rate of speed, made the sketching of our course a haphazard one; it went on, however, as usual from hour to hour. We made our course, by the help of slight puffs of wind, from headland to headland. The dull red of the cliffs and the green of the pines and scrub on the hillsides were a relief to the neutral tone of the water. There were hardly any houses and very little cultivation to be seen.

Shortly after noon we entered the land-locked harbour of Tu-chang. That night we anchored a few miles from the city, and next morning headed northward with a favourable wind. The coast-line had quite changed its aspect, and grassy slopes had given way to stretches of driven sand with low rocky peaks standing bare on the skyline. We landed on a low ridge that stood out into the lake, and climbed up its sandy slopes. On reaching the crest-line, the Ku-ling range stood out boldly in front of us on the other side of the lake, here only about 8 miles wide. Looking due north, we thought we saw the junction of the lake and the Yang-tze; this, however, we subsequently found not to be the case. From where we stood the physical geography of the northern end of the lake stood out like a map: open water, peninsulas, islands stretched into the distant haze. We took to our boat again and sailed across the lake to the walled city of Nan-kang, a town that had evidently seen more prosperous days. We were off again early next morning. We had hoped to reach Hu-ku that night, but the weather had changed for the worse, and we had to run ashore some 3 miles from that town. Next morning the wind had gone down a good deal, but it was still rather unpleasant in a small boat. Rounding the north-east corner of the lake, we suddenly came upon the walled town of Hu-ku, and had reached the Yang-tze. There was a marked contrast between the clear and greenish-coloured water we had been travelling on and the light chocolate flood of the river. Another day's tracking up-stream, and a very dirty night of rain and wind that lashed the Yang-tze into muddy waves, and we had reached Kiu-kiang.

The route-sketch was undertaken to give additional interest to the journeys; it has no pretensions whatever of being a map. Putting the instruments on one side, the conditions under which it was drawn, sometimes by moonlight, sometimes almost in the dark, often on the unsteady platform of a rocking boat, effectually prevented this. Its only merit is that it assists in illustrating a highway that, as far as I am aware, has not been described even with this accuracy before.

ADMIRALTY SURVEYS DURING THE YEAR 1904.

By Captain A. MOSTYN FIELD, R.N., F.R.S., Hydrographer.

UNDER the orders of the Lords Commissioners of the Admiralty, eight of His Majesty's vessels, with three small hired steam-vessels, manned by an aggregate of 76 officers and 740 men, have been employed on hydrographical surveys on various stations at home and abroad. The following is a brief summary of the work accomplished, as detailed in the report prepared for presentation to Parliament:—

Reports of 482 rocks and shoals which were dangerous to navigation have been received at the Hydrographic Department, and were notified to the public through Notices to Mariners; 1139 miles of coast have been charted, and an area of 3993 square miles has been sounded.

Around *Great Britain* various surveys were made.

In *English* waters, at Portsmouth and Plymouth, much close resurveying was done in areas which had been recently dredged. At Dover some careful observations of the tidal streams were obtained. Various re-examinations in the ever-changing Thames estuary were carried out; the Shingles patch was found to have the same depth over it, namely 9 feet, as in 1902, with signs of extension towards the north-west. Further experiments were continued with the manometer, a pneumatic tide apparatus, which it is hoped may eventually lead to the production of a reliable self-recording instrument.

Torbay was resurveyed, and also the western channels of the Scilly Isles with their approaches.

In *Irish* waters, the survey of Youghal harbour, commenced last year, was resumed and completed.

In *Scottish* waters, Inverie bay, Loch Nevis, Ballachulish bay, Loch Linnhe, and Rothesay bay were surveyed. The surveys of Loch Kishorn and the entrance of Loch Carron were partly made, and will be completed, it is anticipated, next year; a survey of the sound of Mull was begun, and Inver Scadle bay, Loch Aber, was examined. The weather in the summer of 1904 for Scotland was exceptionally fine.

In *Newfoundland* waters, an exhaustive and unsuccessful search was made over an area of 350 square miles to ascertain the position of a reported 10-fathom bank, which was searched for in 1892 without success. The survey of the south-eastern portion of the Bay of Exploits was resumed.

In *British Columbian* waters, the survey of the area lying between Ballinac islands and Active pass was finished. Nanaimo harbour and Departure bay were resurveyed. A large-scale plan of Nanaimo harbour, commenced last year, was finished. Plans were also made of Oyster harbour, Active pass, and Dodds and False narrows. A rock reported to exist at the northern entrance to Baynes sound was searched for without success.

On the *West Coast of Africa*, surveys were made of Opobo river bar and approaches, with a sketch-survey of the river between Opobo and Egwanga, the new Government station; of the Brass river and approaches; and of the Nun river entrance and approaches as far as Akassa. At the river Gambia entrance positions of buoys were verified.

In the *Mediterranean*, the Gulf of Corinth as far north as Vurko bay, embracing the approaches to Dragamesti bay, was surveyed, and a large-scale plan was made of Plateali bay (Platea).

In the *China seas* two vessels were at work. The survey of Mirs bay, near

Hong Kong, was resumed at Double Haven and Starling inlet, and was completed. The survey of Port Shelter, which is between Hong Kong and Mirs bay, was begun. The survey of Amoy harbour on a large scale, begun last year, was finished, and of the approaches to Amoy, including Quemoy port. The survey of the British sphere of influence on the Shantung coast was resumed and finished, and a plan was made of Wangkia bay.

In Borneo a survey was made of Gaya and its approaches, with plans of Jesselton (now the terminus of the railway) and of Tega channel.

In *Australasian* waters, on the east coast of North island, New Zealand, 61 miles of coast-line has been surveyed, from East cape to Gable-end foreland, and soundings were obtained over an area of 802 square miles in the vicinity of this coast; 91 miles of coast has been surveyed in Hauraki gulf, from Tiri Tiri Matangi to Tawharanui point, and soundings were obtained over an area of 228 square miles.

In South island, New Zealand, the approaches to Westport and Buller bay, and the approaches to Awarua or Bluff harbour, were surveyed, a large-scale plan being made of the Bluff.

In *Indian* waters, the surveying ship maintained by the Government continued the survey of the Arakan coast, finishing that portion included between Asirgarh shoal and the south point of Western Baronga; Hinzé basin and a portion of the coast of Andaman island remaining from last year's work being surveyed, also Mayu river and a plan of Akyab.

The approaches to the proposed ship canal through Rameswaram island were surveyed, while the surveys of Stewart island, in the Andamans, and various harbours in the Persian gulf are in progress.

During 1904 the Hydrographic Department has published 113 charts and plans, and 60 new plans have been added to the existing plates. The number of charts printed to meet demands has, during the year, amounted to 661,590.

REVIEWS.

AFRICA.

Geology of Tunis.

'Étude géologique de la Tunisie Centrale.' By L. Pervinquière. Paris: F. R. de Rudeval. 1903.

This elaborate monograph is a solid contribution to the geology of North Africa, a subject which is being enthusiastically studied by French geologists, and has, in consequence, a rapidly growing literature. It is supplementary to a description of the physical geography of the district by the same author, published a few years ago, and contains a useful map on the scale of 1 : 200,000, and a full bibliography. The rocks are principally Cretaceous and Tertiary, but older beds are known also (Trias and Jurassic), and there are igneous masses of unknown age. Elaborate details are given of the exposures examined, with lists of the fossils collected; and, as very little was previously known of considerable parts of the district, the book is likely to be for some time the principal authority on the subject of which it treats.

POLAR REGIONS.

Recent Literature of the Antarctic.

'Vers la Terre polaire australe.' Par E. Pariset. Extrait des Mémoires de l'Académie de Lyon. Lyon: A. Rey. 1904. Pp. 134.

'The Belgian Expedition under the Command of A. de Gerlache de Gomery.' Summary Report of the Voyage of the *Belgica* in 1897, 1898, 1899. Brussels: Hayez. 1904. Pp. 70.

'Au pays des Manchots.' Recit du voyage de la *Belgica* par Georges Lecointe. Bruxelles: Oscar Schepens & Cie. 1904. Pp. 368.

'Zum Kontinent des Eisigen Südens von Erich von Drygalski. Deutsche Südpolar-expedition.' Fahrten und Forschungen des Gauss 1901–1903. Berlin: Georg Reimer. 1904.

'*Antarctic*. Zwei Jahre in Schnee und Eis am Südpol.' Von Dr. Otto Nordenskjöld, J. Gunnar Andersson, C. A. Larsen, und C. Skottsberg. Nach dem Schwedishen Original ins Deutsche übertragen von Mathilde Mann. Berlin: Dietrich Reimer (Ernst Vohsen). 1904.

'*Antarctica*, or Two Years amongst the Ice of the South Pole.' By Dr. N. Otto G. Nordenskjöld and Dr. Joh. Gunnar Andersson. London: Hurst and Blackett, Limited. 1905.

The volume of Antarctic literature has been expanding rapidly during the few years of the present century, and for a time the increase promises to continue. So much that is new has to be recorded and described that there may be a tendency to overlook the earlier efforts in the light of the splendid achievements of recent expeditions. In this article we propose to notice a batch of books which have little in common save their centre of interest in the region surrounding the south pole. Their variety promises well for the further multiplication of works on the same subject, rousing new interests and avoiding the monotony which casts a gloom over many works of travel.

In his modest little summary of the history of Antarctic exploration, M. Pariset makes use mainly of the admirable work of M. Rainaud, 'Le Continent australe, hypothèses et découvertes,' the no less able treatise of Dr. Fricker, entitled 'Antarktis,' Mr. Balch's invaluable 'Antarctica,' and the 'Antarctic Manual.' With such guides he has been able to present an excellent epitome of the early speculations and the later voyages of discovery. The record is carried down to the return of the *Discovery* and the *Scotia*. Though accurate as a rule, there are some blunders, as in the statement with regard to Mr. Borchgrevink, 'Il obtint le patronage de sir George Newnes, et par cet influent lord le concours de la puissante Société royale de géographie de Londres." It is an error, also, to say that Sir James Ross's expedition of 1843 was under the patronage of the Royal Geographical Society. M. Pariset has permitted a good many misprints of names of persons and places to escape his attention; we have noted nineteen of these, ranging from *Hobbart-Town* to *Mossmannn*.

The other books are narratives of exploration. Two concern the Belgian expedition, of which the first is an excellent English translation of the commander's summary report, which must henceforth be the standard narrative of the events in our language. It contains full particulars of the Commission for working up the results, and the names of the authors of the reports. The second is yet another personal record of the voyage, and one by no means inferior in interest to those of M. de Gerlache and Dr. Cook, for it is written by M. Georges Lecointe, the second in command of the expedition. The book is capital reading, the author displaying a happy knack of discovering a silver lining of humour in the blackest clouds

of discomfort and danger which overshadowed the expedition. The one drawback is that his too frequent use of nautical terms makes the perusal something of a burden to those who, like Kipling's engineer-hero MacAndrews, have not been privileged to—

"... sail
With such as call a snifter-rod *Ross* ... French for nightingale."

No account of the cruise of the *Belgica* we have read has brought home to us so fully as this the tragic elements in the attempt to fit out an expedition on the miserable pittance scraped together with such an infinity of pains by de Gerlache and his companions. Official polar expeditions have, as a matter of tradition, double pay secured for all officers and sailors, and the pick of a navy to man the ship, the best instruments that money can buy, and a scientific staff—when one is carried—comfortably housed and paid at least as much as they might reasonably expect to earn by scientific work on shore. But on the *Belgica* the whole equipment was full of humiliations for the officers in charge. The miserable engine was always breaking down, the anchor-chains jammed at the critical moment, the crew were in large part the scum of several nations, seldom respectful, often mutinous, and ultimately half mad as a result of the inadequate food and poor accommodation. The scientific staff were not only unpaid, but themselves assisted the finances of the expedition as far as their slender resources allowed. That the result was not ignominious failure is surprising; that it was a conspicuous success exalts the efforts of those on board who had the interests of the expedition at heart to a high level of heroism. Lecointe's own work, suffering as he did continually from seasickness, was prodigious. Arctowski and Racovitza collected and in large part discussed a vast amount of entirely new scientific material. The cheery enthusiasm of Cook and his medical skill kept the whole party together, though at times, after the death of Danco, things looked very black indeed. Everything was due to the unfaltering determination of de Gerlache to lead a south polar expedition, even if we read between the lines that the commander at times lacked that firmness and decision which are essential to a perfectly successful leader. No praise can be too great and no honours too high for those men who persevered and triumphed in the face of the indifference of their country, and in spite of every difficulty which the ingenuity of the Adversary could have piled upon Job himself.

The popular narratives of the German and Swedish Antarctic expeditions by their respective leaders appeared with a most creditable promptitude, which deserved the recognition of an earlier review. Both Prof. von Drygalski and Dr. Otto Nordenskjöld have personally addressed the Royal Geographical Society, and the authoritative narratives of their experiences have duly appeared in these pages, accompanied by a fine selection of their photographs. It is, consequently, unnecessary to summarize the incidents of the voyages and the winterings in the present article, but we must give a meed of praise to the books.

Prompt publication of reports of scientific work has characterized the expedition of the *Gauss* from the commencement, and an account of each section of the voyage was published by the German Oceanographical and Geographical Institutes in Berlin as soon as it was received. Prof. von Drygalski's book, however, contains a great deal that is both new and interesting; though its bulk has wisely been restricted to a single volume, its page has an ample size doing full justice to the photographs with which it is adorned.

The book shows that the voyage of the *Gauss* aimed at much more than polar exploration. It was a small *Challenger* expedition in a ship specially adapted for ice-navigation, which wintered in the ice. The first place must be given to the importance of the oceanographical work on the voyages out and home. By the

cruises of the *Valdivia* and the *Gauss* the leading place in oceanography seems to be passing from Great Britain to Germany, though the fine work carried out on the *Scotia* shows that we have not yet taken the second place. Almost one-half of Prof. von Drygalski's book is devoted to the description of voyages and work in temperate and tropical seas, with excursions on land at various points. The other half describes the discovery of new land between the discoveries of Biscoe and Wilkes, the wintering in the frozen sea off the previously unknown coast, and various expeditions by sledge and on foot to the inland ice and the interesting nunatak of the Gaussberg. The ice-structure was studied with the care and intelligence that the brilliant work of the leader in earlier years in Greenland led one to expect.

It was extremely unfortunate that the condition of the ice made it impossible to trace the new land, Kaiser Wilhelm II. Land, either towards the east or the west. To the east high land was seen apparently not more than 60 miles from the ship, but it was not visited, nor is it even named; the map merely designates it "High Land." Drygalski mentions in a footnote that, though he gives the land no name, it is still questionable whether it is Wilkes's Termination Land or not. It certainly is not in the position to which Wilkes assigns it, though Wilkes never professed to fix that position definitely; but though the *Challenger* and the *Gauss* herself showed that the Termination Land of the maps was non-existent, the new "high land" lies on the same bearing, and in the Antarctic it is well known that amazing variations in visibility often occur. The probability seems to be that Termination Land does exist probably not further from the position suggested by Wilkes than is Alexander Land as seen by Gerlache from the position laid down by Bellingshausen.

Dr. Nordenskjöld's book has reached us in the form of two translations—the English in one volume, the German in two. Externally the German edition is the more attractive, the design on the cover being particularly neat; but the English version fails in no other respect. The book consists of the narratives of the leader and of his companions, Dr. Gunnar Andersson, Captain Larsen, and Mr. Skottsberg, whose names appear on the title-page. The novelty is fully justified by the freshness with which the story is told of each of the three parties into which the expedition was involuntarily divided during the second winter on the southern land. The dramatic episodes of the loss of the *Antarctic*, the successive meetings of Nordenskjöld with Andersson on the ice, with the Argentine party sent in search of him, and lastly with Larsen, are turned to good account. A feature of the book is the intermingling of very clever sketches—some striking pieces of colour amongst them—with the numerous photographs. The English translation is so well done that one looks for the translator's name as in the German edition, but it is not there.

The map of the great peninsula of Antarctic land has been enriched by several new names, but several changes of name are also shown, which we consider ought to be arranged, when necessary, by some international body, such as the International Geographical Congress, because it is very awkward to have different names in different works of reference, and there is at present no authority to turn to when a doubtful point of nomenclature has to be settled. The coast of Oscar Land will find work for several future explorers, and as it was laid down by Nordenskjöld from a distance, it may have surprises in store for the first man who actually lands upon it and explores its bays to discover if haply they may be fjords or even channels leading to the western ocean.

Indeed, the feeling left on the mind by the perusal of the narratives of all the recent Antarctic expeditions is that they are but the introduction to the systematic

exploration of the south polar area, to which their efforts have directed attention. The problem is in no way settled, the most interesting of the old questions have not yet been answered; a whole host of new questions have been proposed, and the great bulk of the Antarctic Region still lies upon the map as blank a blot as ever, still holding out the old invitation which cannot long be disregarded—"Come and see." H. R. M.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Economic Geography.

'Natur und Arbeit.' By Dr. Alwin Oppel. Leipzig and Vienna: Bibliographisches Institut. 1904.

'Grundriss der Handelsgeographie.' By Dr. Max Eckert. Leipzig: G. J. Göschen'sche Verlagshandlung. 1905.

Dr. Oppel's large work, extending to upwards of eight hundred large 8vo pages, is invaluable both on account of the abundance of matter in the text and its great wealth in illustrations, including maps. The nature of the work will be best gathered from an account of its contents. It is divided first into two great sections, one dealing with the conditions and history of economic activity (*Wirtschaft*), the other, comprising two-thirds of the entire work, dealing with the economic activity of the present time. The subdivisions of the section on the conditions of economic activity treat respectively of the Earth's crust, water, air, the vegetable world, and man. The historical section brings us down from the most primitive times to the eighteenth century. The section on the economic activity of the present time is divided into seven sub-sections, treating respectively of general conditions (forms of economic organization, the relation of economic activity to the character of the surface, the influence of race, the science of economics, the state in relation to economic activity, colonial systems, capitalism, machinery, etc.), the production of minerals, that of commodities in the raw state of vegetable origin, similar commodities of animal origin, handicrafts and manufacturing industry, trade, and means of communication and transport.

From this account it will be observed that the plan is not geographical. There is no regional geography, although notes on geographical distribution are given under every heading that makes such information appropriate. Under all the headings the author shows remarkable power in briefly summarizing the most essential facts; the illustrations are well selected, and the numerous coloured maps, some of which must have involved great labour to compile, very instructive. Some of these maps might be criticized in details, but neither in the text nor in the maps has any important error fallen under the notice of the present reviewer.

When there is so much to say in praise of the work, it will be understood that any indication of deficiencies is made solely in the hope of seeing improvements in a later edition. It is to be regretted that the history of economic development is not continued from a general point of view beyond the end of the eighteenth century. If that had been done we should probably have had more than the mere incidental references to water-power, which are all that is to be found on that head at present. Probably, too, the importance of improvements in artificial lighting in relation to economical development would have been appreciated and duly set forth. As it is, we have only an incidental mention of electric lighting under electricity (somewhat strangely introduced as one of the subordinate divisions under the head of the atmosphere in the first part), and a similar incidental mention of incandescent mantles under zirconium and thorium. The continuation of the historical point of view would probably also have suggested to the author the desirability of giving

information as to the manning of ships at different periods—of sailers in the old fighting days as compared with the present day when ocean-routes are as safe as those on land; of the large sailers of the present day as compared with cargo-steamers of corresponding tonnage and with ocean flyers.

In Eckert's work, as might be expected from the title, the geographical point of view predominates. It is in two volumes, the second of which is entirely devoted to regional geography, and is more than twice the size of the first, which treats of the geography of production and exchange under general heads, or with reference to commodities. The arrangement is thus similar to that adopted in several other well-known text-books on commercial geography. Among the specially good features of the first volume may be mentioned, in addition to sundry comparative statistical tables, the sections on the carrying capacity of various means of transport by land and water (pp. 143–4), the similar statement on p. 146 with regard to the rate of transport (though in this statement river-steamers and canal barges are unfortunately not included), the list of fastest trains, that of the fastest steamers on great ocean waters, the statement of time taken in 1903 on the trans-continental railway journeys—Lisbon-Paris-Berlin-Dalni and New York-San Francisco (pp. 147–9), the table of European time-distances from Berlin (pp. 153–7), the section on money and the ratio of exchange of gold and silver at different dates (pp. 169–71), and the sketch of the stages in the commercial history of the world (pp. 172–4). In this last section it is rightly pointed out that a great distinguishing feature of the commerce of the past and present lies in the fact that it is only in modern times that bulky goods have entered into the commerce carried on between remote parts of the world, but hardly enough stress is laid on the fact that this is specially a feature of the railway period. Pages 193–7 contain some just and suggestive estimates of the future trade-routes of the world.

A notable feature of the volume on regional geography is the inclusion of the colonial possessions of different countries under the countries to which they belong, which from a geographical point of view is very unsatisfactory. The result is that for all that properly belongs to regional geography, in the case of the colonies, one must refer to the brief notices of the continents to which they belong, the sections on the colonies furnishing mere details without geographical nexus. Among the British possessions, Nigeria, British East Africa, and Uganda get just as much notice as Christmas, Fanning, and Palmyra islands; that is, a mere mention. Egypt has two pages devoted to it, under Turkey; but even the joint dominion of Britain and Egypt in the Egyptian Sudan has not secured for it a mention in the list of British possessions. In both volumes, but especially in the second, there is an excessive heaping up of detail in a form in which it is of little or no use, or at least in one more proper to a statistical annual than a geographical text-book, together with an absence of insistence on important and significant details. Both volumes, moreover, contain many details of greater or less importance that await correction in a future edition. Each volume is provided with an index, in which, however, no attempt is made to distinguish the more important references. A bibliography of eleven pages is appended to the first volume.

G. G. C.

GENERAL.

More Geographical Text-books.

'Dodge's Elementary Geography;' 'Dodge's Advanced Geography.' Chicago, New York, London: Rand, McNally & Co. 1904. Small 4to. Pp. 231, 333, xix.

Prof. Dodge, of the Teachers' College, Columbia University, New York, has planned a new series of geographical books for American schools. Each work

consists of two parts—I. Elementary, containing (1) Home Geography and World Relations, (2) Elements of Continental Geography; and II. Advanced, consisting of (1) The Principles of Geography, and (2) Comparative Geography of the Continents. This distribution of the subject-matter, as well as the method of presentation, from consequences to causes in the elementary book, and from causes to consequences in the advanced book, are to be commended. The large number of views, usually well chosen, maps of varying value, and statistical diagrams, add to the value of the books. The General parts of the work and the United States are the sections which will be read with most interest by teachers in this country, and these they will find instructive and accurate. The other parts are not so well done. The author has been particularly unfortunate in the case of the illustrations of the British Isles. In the elementary book Derwentwater is shown as in the "Scotch lake country," while two spinning-wheel scenes, an old-fashioned farmhouse kitchen, and peat-cutting—without which, of course, no American collection of photographs of the old country would be complete—are selected, along with views of sheep and cattle, to represent British industries. In the advanced book a view of "Glenariff, Scotland, where the highlands and lowlands meet," must puzzle every reader who notices the typical valley cut in a plateau, in this case that of Antrim. The picture called "Looking over the English lowlands called 'downs'"—an unfortunate phrase—is an equally unfortunate selection, for the downs are nearly invisible. "Lima Glen, Scotland," is an American name unknown here, and Keswick is placed in Scotland. There is the common misuse of English for British. There are a number of statements to which exception might be taken, such as "France is not a great commercial nation" (its foreign trade is almost as great as that of the United States, which we presume the author would not describe in this way), "the Orange River colony is famous for its mines," "the diamond-mines here are the greatest in the world," "the Southern Alps rise to an altitude of 7000 feet," and a number of others. With a very thorough revision in a second edition, the value of these two volumes will be greatly enhanced.

Greater Britain.

'A Historical Geography of the British Empire.' By Hereford B. George. London: Methuen & Co. 1904. *Price* 3*s.* 6*d.*

It is not without significance that a third of this volume deals mainly with the British Islands and the geographical conditions, from the earliest times, which have determined their development. It is worth reminding ourselves that the size and picturesqueness of the geographical phenomena of a region are not always an index to its real importance in the present organization of the world. So there is good ground for devoting considerable space to the conditions which affected the political unity of England before the Conquest, while Scotland and Ireland receive a shorter but similar treatment. In modern times the economic rather than the political aspects of the question are necessarily emphasized. The real difficulty, after the early period, is to attain a consistent picture of general development in the light of geographical principles. There is much purely historical matter which has no very definite geographical basis; and some of the geography would, perhaps, be more in place in a modern descriptive text-book. But, on the whole, a fairly definite impression can be gathered of the growth of the British Isles in the light of geography. The same can scarcely be said of the sections dealing with the Empire at large. We have first the "stepping stones," mainly the islands; then the daughter nations, Canada and Australia; then the dependencies, India and the West Indies; then the protectorates, and finally the

British dominions in Africa. There must necessarily be a certain amount of cross-classification in any attempt to deal systematically with the whole empire; but by the above method the continuous and connected growth of a complicated organism is not made clear; the connection is often implied, but careful search is needed for its elucidation. The impression produced is that of an encyclopædia of historical and geographical facts, which the ordinary reader is more likely to use for casual reference than for continuous study. A. J. S.

A Geographical Calendar.

'Geographen-Kalender.' In Verbindung mit vielen Fachgenossen herausgegeben von Dr. Hermann Haack. Dritter Jahrgang, 1905–1906. Gotha: Perthes. 1905. *Maps and Portrait. Price* 3.50*m*.

The third issue of this useful handbook shows some further developments, bringing still nearer realization the aim of its originators to make it an indispensable work of reference for geographers throughout the world. Such it may certainly be considered, for all who have once made use of the information supplied by it in so handy a form would at once find themselves at a loss were the help thus afforded them withdrawn. Particularly useful, even in the first issue of the 'Kalender,' was the comprehensive list of geographers of all countries, with addresses, giving as it does information to be found in no similar publication. In the present issue this list has been largely extended, and includes not only the names of all who have in any way contributed to the progress of modern geography, but of many representatives of kindred sciences—geology, astronomy, economics, etc. A change of some importance has been made in the section treating of the literature of geography, which now takes the form of a simple bibliography rather than a review of the literature of the year. In this way it has been possible to make it far more comprehensive than before, the number of separate titles inserted being well over two thousand. The sections on exploration and events of wide political or international importance—both this time by Prof. Langhans—continue to give a concise but comprehensive survey of the events of most importance in these directions, being illustrated besides by an unusual number of maps. The first section, entitled "Kalendarium," adds a number of useful tables to those contained in former issues, including tables for the mutual conversion of metric, English, and Russian measures of length. The portrait now given is that of Prof. Reclus.

THE MONTHLY RECORD.

EUROPE.

Autumn Rainfall and Yield of Wheat in England.—Dr. W. N. Shaw, secretary of the Meteorological Council, has pointed out the close relation which seems to exist between the amount of rainfall in the autumn months (*i.e.* approximately September, October, and November) and the yield of wheat in England during the following summer. A preliminary note on the subject, which he is further investigating, was given in the *Proceedings of the Royal Society* for April 10, 1905. An examination of the returns of rainfall and yield of wheat since 1884 for the "Principal Wheat-producing Districts" shows that the dryness of autumn is the dominant element in the determination of the yield of wheat of the following year. So much is this the case, that Dr. Shaw has been able to work out an

equation between the amount of autumn rainfall in inches and the yield of wheat in bushels, and finds that, by the use of this equation, the yield could have been computed within 2 bushels for fourteen years out of the twenty-one; the extreme variation during the whole period being as much as 9 bushels. There are, of course, various years in which the agreement is upset by specially unfavourable conditions in summer, and this suggests the inquiry whether the connection traced is an immediate or, in part at least, a secondary one, *i.e.* whether it may be that a dry autumn is more likely than not to be followed by beneficial weather conditions during the following year. It would thus be of interest to know the summer conditions in the case of years in which the closest agreement between the yield of wheat and the dryness of the preceding autumn has been traced.

Lower Brittany.—In an article in the *Annales de Géographie* (No. 73, xiv. année) devoted to the evolution of rural life in Lower Brittany, and marked equally by human interest and scientific perspicacity, Prof. Camille Vallaux recounts and estimates the geographical factors which have contributed to the formation of the character of the people of that region. Morally, Brittany still counts in France as the unique survival of an age long outlived elsewhere. This archaic stamp is due, first and foremost, to the geographical seclusion of the district. Its isolation on three sides from the rest of the continent was much more accentuated in the time of sailing vessels. Despite the number of anchorages offered by the coasts, the navigation of the encircling sea was extremely difficult for coasters. Not to speak of squalls, the tidal currents run perpendicularly to the entrance of the bays, estuaries, etc., at the rate of 2 to 3 knots on the south, 5 to 7 on the west, and 2 to 6 on the north, and in the midst of dangers caused by the crumbling away of the granitic rocks of Léon and Cornouailles (continental Cornwall). Internally, again, the land is parcelled out into compartments markedly separate from a geographical point of view. Their short course to the sea and the impermeability of the rocks they traverse give to the streams a supra-torrential character, witnessed by their fall, in most cases, of 7 to 17 per 1000. Add the excessive humidity of the climate, due to an almost equal distribution of rain among the seasons, the very numerous springs and bogs, and it will be understood how, in this land, water is as much an obstacle as an aid to rural cultivation. Even to this day denuded plateaux, eroded crests, and bogs oppose serious difficulties to agriculture. The zone between valley and crest would seem the only land available, and this had to be cleared of the forest covering it. The former extent of forest is approximately determined by documents, eked out by study of the region itself. Save in a few protected spots, the violence of the brine-charged west winds allow no footing to forest at less than 3 to 6 miles inland. Inland, again, the Arrée and Noire mountains, of sandstone and quartzite respectively, are unfavourable to natural forest. But apart from shore-land and mountain tops, forest pretty well covered the whole country, and was particularly thick in the legendary Brocéliande, which, as indicated by local names, extended west to the base of the Arrée. The extent of forest in Cornouailles is also fairly established. There was thus a very extensive forest belt, between crests and inundated valleys, amenable to culture. The lands easiest of subjugation, and so first attacked, include the few alluvial plains along the coast (Plounéour-Trez and Lesneven), the littoral granites of relatively rapid superficial decomposition (coast border of Léon and Cornouailles), and the schists of the Châteaulin basin. In these regions are the fewest remains of forest and landes. The inland granites, on the other hand, still bear respectable forests (Duault, Loudéac, Beffou, Coat an Noz, Coatlo'ch). With the exception of those of Plouray and Lanvaux all the landes, again, in Lower Brittany at least, belong to the region of quartz sandstone. Traces of ancient enclosures on the most arid

spots of the Arrée and Noire mountains tell the tale of unscientific experiments at cultivation. The surplus of water with which the peasant had to contend was aggravated by the numerous watermills he set up on the lowest streams. Down to this day the little mills are a characteristic feature of the Armoric landscape, and are but slowly giving way to the great *minoteries*. The paper shows vividly how the geographical partition of the soil into narrow separate belts induced a corresponding social and economic partition into small groups with little or no intercommunication. A graphic picture is given of the lonely village and still lonelier farm. The remark of Cambry (1794) is cited, how in passing from Léon to Cornouailles, thence to Trégorrois, thence to Vannetais, the traveller in each passage has the impression of passing into a new world in respect of language, costume, habits, social instincts, and human physique. The interest of the paper is fully sustained, as it traces the extent to which this so long isolated corner of France has been and is being transformed by absorption into the actual life of to-day.

Changes in the Hydrography of the Mouth of the Weser.—There are few districts in which the coast-changes which have taken place within historical times can be so well studied as in the German portion of the North sea border, where the low-lying coastal flats are liable to the constant encroachments of the waves and tidal currents. The latest study in detail of such changes has been made by Dr. F. Schucht, of Berlin, in the *Mitteilungen* of the Vienna Geographical Society for March last (vol. 48, No. 3). The changes to which the mouth of the Weser has been subject since the beginning of the sixteenth century, when the catastrophe known as the "Antoni-Flut" took place (1511), can be determined with some certainty by the help both of historical documents and geological research, and Dr. Schucht is able to lay them down clearly in a map which accompanies his paper. Much help towards a reconstruction of the former hydrography is afforded by the fact that the depth to which the carbonate of lime has been washed out of the silt and mud is, to a certain extent, a criterion of the date of their deposition. In the oldest deposits the process has been carried on to a depth of over 6 feet, while in the case of those which date only from 1511 its effect is not noticeable below 10 to 20 inches. A second criterion of age is the occurrence or otherwise of the "Warfen" (embankments or platforms of made ground), on which the early inhabitants formed their settlements, but which, with the increasing encroachments of the sea, have within the last few centuries been replaced by sea-walls or dykes. Almost all of the latter are of more recent date than 1511. Dr. Schucht's studies have led to results in close agreement with those lately obtained by G. Sello, and they show that current statements with regard to former channels of the Weser are in many cases incorrect. Thus the idea of a western branch, running into the Jade by way of the Line is unfounded, though it is the case that, down to the time of the "Antoni-Flut," an arm passed into the Jade a little further north, by way of the Lockfleth, while smaller connecting channels existed along the courses of the Ahne and Heete. West of the Jadebucht a channel existed along the line of the Made, the site of Wilhelmshaven being then part of an island. Dr. Schucht's map also attempts the representation of the coast-line at a still earlier date, before the Marcellus-Flut of 1219, the invasion of the sea having then reached a still less advanced stage.

Surface Forms of the Scandinavian Mountain Chain.—At the Vienna geographical gathering of May 8, 1904, Dr. Fritz Machaček delivered a lecture on this subject, giving the results of his own observations. Speaking of the problems presented by the structure of the fjeld, he drew special attention to the prevailing plateau character of the chain, a character altogether independent of the altitudinal

relations, and effected by levelling of the Palæozoic chain. E. Richter, who brought the formation of this peneplain into connection with the cirque problem, assumed that the cirques were bound up with a definite fall of level towards the north, and were found only on isolated elevations rising above the fjeld-level. This assumption was at variance with the observations of the speaker, who found cirques at various heights, as also on the slopes of the trough-valleys. Seeing that the cirque-walls were in no case polished, the formation of the cirques must in the main be assigned to post-glacial time, and it might, perhaps, be possible to ascertain the relations between the varying configuration of the cirques, the height of the cirque floors, and the particular stages of retrogression of the glacial snow-line. Richter was of opinion that, as the backward cutting of the cirques progressed, and after removal of the dividing ridges, the undulating fjeld surface at last resulted. The circumstance, however, that along with this forms of Alpine type also appeared, was to be accounted for neither by mineralogical differences nor by recent crust-movements. The lecturer further deemed it impossible for extensive peneplains to have been formed by any amount of cirque-cutting. In his view, therefore, it was under the firn-covering that the fjeld preserved its pre-glacial surface, and the later demolition gave rise to rugged Alpine forms. This happened more particularly where the partition into valleys was most active and the snow-line lay deepest. The speaker pointed, moreover, to the circumstance that above the peneplain a higher summit level was likewise of constant occurrence, so that, in keeping with the investigations of Hans Reusch, two levels were to be distinguished, the formation of which, especially of the deeper and more recent, was, in all likelihood, assignable to the production of a peneplain, as understood by W. M. Davis, in the Tertiary age. The speaker next dealt with the trough-valleys, their sharp edge, the "shoulder" (the origin of which was not yet, he said, sufficiently elucidated), the "over-deepening," and the doubtful traces of valley-ledges, the step-structure of the fiords and fiord-valleys, the coast plain and its relation to the coast-lines, on which Richter and Vogt were of different opinions. In the discussion, Hofrath Penck, who in general concurred with the lecturer's views in opposition to those of Richter, traced the course of development of the inquiry. Whereas two to three decades ago the fiord problem was in the forefront of the discussion, it was now to be accounted as solved, and the forms of the fjeld had become the main problem, a change of situation due in large measure to the contributions of Eduard Richter.

ASIA.

Standard Time for India.—We are informed by the India Office that the Government of India has decided, with the general concurrence of the local authorities concerned, to adopt for their railways and telegraph offices a standard time, which in India will be five and a half hours, and in Burma six and a half hours, in advance of Greenwich time. The application of the new system to other departments, *e.g.* to meteorological observations, has not yet been decided on, but will be separately considered.

The Russian Expedition to the Khatanga, Northern Siberia.—According to a note in *Petermanns Mitteilungen* (1904, No. 4), this expedition, to which we alluded briefly in the May number (vol. **25**, p. 564), safely reached Turukhansk, on the way to Lake Yessei, early in the present year, having traversed the distance from Yeneseisk in two sections.

AFRICA.

M. Gautier's Researches in the Algerian Sahara.—Valuable additions continue to be made by the French to our knowledge of the southern borderlands

of Algeria, and by no one has more important work been done than by M. E. F. Gautier, whose qualifications as a geologist have enabled him to do more than the majority of African travellers to unravel the problems of the physical geography of the continent. M. Gautier's latest researches, brief accounts of which appear in the June number of *La Géographie*, have been carried out in the Tuat region, where he has made various excursions towards the west of the oasis. This, he says, does not form, as has been supposed, a basin, for towards the west it has no definite border, but forms a boundless plain broken by sandhills. Another fact brought to light is that the Wed Messaud, which was vaguely shown in some former maps, but which has lately been struck out as non-existent, is distinctly to be traced as part of an old drainage system, of Quarternary times, which is comparable to that of the Igharghar. The Messaud (of which the Wed Saura is an upper branch) has no connection with the chain of Sebkha which traverses Tuat, and occupies the line of a great fault, but runs much farther west along the edge of the little-known mass of dunes known as the Erg-esh-Sheikh. The whole system, by which the plain of Tuat was formerly drained, converges to the south-west on the salt-pans of Taudenni, which recall those of southern Tunis in which the Igharghar loses itself. From the fact that each of the great series of dunes in this region is associated with an old river-system, M. Gautier throws out the suggestion, though with much caution, that such dunes have been formed only where the former action of water has prepared the way by forming alluvial deposits. This idea will hardly be accepted without much discussion, as it tends to modify profoundly our notions of the processes of erosion and deposition in deserts.

French Surveys in the Chad-Niger Region.—Captain Tilho, who was attached to the French section of the Anglo-French Boundary Commission in Nigeria, has, since the operations of that mission were concluded, continued his surveys in the same region, especially on the eastern side of Lake Chad. Some account of his work was given in *La Géographie* for March, 1905 (vol. 11, pp. 226–230). For the survey of the labyrinth of channels on the eastern side of the lake he joined Naval-Lieutenant Audoin in the *Benoît-Garnier*, and though a severe attack of fever compelled him temporarily to make his way to the drier districts of Kanem away from the lake, he was able to do a considerable amount of mapping of the complicated features of the lake's hydrography, besides fixing the position of Mao, the capital of Kanem, and other localities. Lieut. Audoin, who is said to know the lake better than any other European, vainly endeavoured to find a navigable channel between the north-eastern and southern archipelagoes, being compelled to adopt a course which took him close to the British shore. Captain Tilho describes the winding channels which cut up the country on the east of the lake as forming a chaotic maze, from which the traveller finds it difficult to extricate himself, while without caution he may easily lose his life in the deep sloughs which encompass him. Seen from the north, *en route* for Zinder, the lake was one melancholy expanse of dry reeds. In this direction some positions were fixed along the frontier constituted by the Anglo-French arrangement of 1904, the homeward route then leading to the Niger and up the course of the river to Senegal. Numerous astronomical observations, taken along the upper Niger seem to show that its course is placed on our maps some 12 miles too far east, between Timbuktu and Gaya.

Exploration in the Ogowe Basin.—The same number of *La Géographie* records an exploration of the Ivindo, the northern tributary of the Ogowe, by M. Vaille, who, starting up the river in canoes, made the ascent amid great difficulties, caused by the furious rapids which obstruct its course, principally in its lower part. Some of the falls have a height of 110 to 150 feet and over

Higher up the river flows on a plateau, and here its swampy banks make communication impossible in the rains.

D'Anville's Map of Africa and its Sources.—The claim of D'Anville to foremost rank among the geographers of his day is very generally acknowledged, but few, perhaps, among modern students of geography could point out off-hand the precise grounds for that pre-eminence, or the way in which it was attained. The critical study of his map of Africa, first issued in 1749, which has been undertaken by Dr. Max Vollkommer of Munich (*Münchener Geogr. Studien*, No. 16, 1904), is, therefore, both welcome and instructive. In a brief introduction the author traces the outlines of D'Anville's career, laying stress on the qualities—especially the excellent critical judgment and power of sifting the true from the false among the materials in his hands—which enabled the great French cartographer to carry forward with such distinguished success the advance in map-making methods already inaugurated by Delisle.* The bulk of the memoir consists of a detailed examination of the authorities on which D'Anville's map of Africa (perhaps his most valuable service to cartography) was based in its several parts; and this enables the reader to realize in a striking way the vast industry and care employed in the collection and sifting of the material, derived both from the ancient writers and the reports of recent travellers. That the result was largely a negative one, as shown by the wide blank which occupied the centre of the map, was not the fault of the cartographer, but was due to the exceedingly scanty knowledge of the African interior existing at the time. As regards his delineations of some of the newly explored parts of the continent, especially Abyssinia, D'Anville certainly owed much to his predecessors; but while he, in the main, followed Tellez and Ludolf, he introduced certain alterations which prove that he had himself carefully studied the whole material available. As regards the Nile, he made a step in advance of Delisle's ideas by showing the Bahr-el-Abiad as a distinct stream—the main head-stream, in fact—while Delisle had identified it with the Maleg, a tributary of the Blue Nile. D'Anville's genius is strikingly shown when we look at his delineation of the western and Central Sudan, for which he had largely to rely on the older writers—Ptolemy, Edrisi, and Leo Africanus in particular—whose accounts he interpreted with great judgment, although naturally falling into many errors of detail. His separation of the Niger from the Senegal, and assignment to the former of an easterly direction, were decided services to the geography of this region. But none the less important was his mapping of the coast regions of the continent, which, being based on a study of all the most recent material, gave for the first time a trustworthy picture of the then-known portions of the continent in their true proportions, thus supplying the needed basis from which to work when the bounds of knowledge were at last advanced towards the interior.

AMERICA.

United States' Coal Industry.—A recent consular report (No. 631, Miscel. series) discusses the coal-production of the United States in 1903. In that year the total output amounted to 319,068,228 tons, the largest yet recorded, and exceeding that of 1902 by 50 million tons. The coal output of the United Kingdom in 1903 was 230,334,469 tons, 89 millions short of that of the United States. Anthracite coal is produced mainly in the state of Pennsylvania, where

* The writer holds that the attempt to put forward the German cartographer Hase as the originator of the critical cartography of Africa is unjustifiable, as his map of 1737 was itself based in part on some of the earlier work of D'Anville.

from an area of 484 square miles, the yield in 1903 was over 66½ million tons. Outside Pennsylvania, anthracite coal is worked only in Colorado and New Mexico, from which the yield was only 65,000 tons. Of bituminous coal, found in almost every state, and extending over more than 300,000 square miles, the Triassic coalfield in Virginia and New Carolina, ranging over 1070 square miles, produced in 1903, 31,601 tons; the Appalachian coalfield, extending from New York to Alabama State, over 70,807 square miles, nearly 166 million tons, of which more than half was the contribution of Pennsylvania; the northern coalfield, in the centre of Michigan State, with an area of 11,305 square miles, gave an output of 1,221,088 tons; the central coalfield, extending through Indiana, Illinois, and West Kentucky, over an area of 58,000 square miles, 46,545,407 tons (32,997,414 tons being the contribution of Illinois State alone); the western coalfield, between the Mississippi and the Rocky mountains (94,076 square miles), 20,689,010 tons; the Rocky mountains coalfield (100,110 square miles), 15,161,661 tons; and the Pacific coast coalfield (1050 square miles), 3,026,641 tons, of which 2,851,137 tons was the production of Washington State alone. Of the states, Pennsylvania, with its 92 million tons (mostly anthracite)—49·8 per cent. of total output in 1903—and employing 129,265 workers, is the coal state *par excellence*. Next, at a long interval, stands Illinois, producing near 33 million tons, 8·6 per cent. of total output, and employing 50,596 workers; then West Virginia, with 26 million tons, or 6·8 per cent. of the total, and Ohio, with 22 million tons, or 6·3 per cent. of the total. The total exports of coal in 1903 amounted to 8,813,000 tons, of which 0·79 per cent. went to Canada, 10 per cent. to Mexico, and 8 per cent. to the West Indies. The United States' import of coal in 1903 amounted to 3,446,402 tons, of which 1,785,720 tons came from Canada; 1,511,924 tons (bituminous) and 337,291 tons (anthracite) from the United Kingdom, and 296,955 tons (bituminous) from Australasia. The imports of anthracite were equal to about 0·005 per cent. of the total production, and the imports of bituminous coal to 0·01 per cent.

Dr. T. Koch's Journey on the Upper Uaupes, Brazil.—Among the great tributaries of the Amazon the western branch of the Rio Negro, generally known by the name Uaupes, has remained till the present day one of the least visited by white men. Since the river was ascended and described by Wallace not much after the middle of the nineteenth century, almost the only scientific traveller to touch upon this region was, until quite lately, the Italian Count Stradelli. Last year a visit to the headwaters of the stream was made by Dr. Theodor Koch, a letter from whom, briefly describing the journey, has lately been printed in *Globus* (vol. 87, No. 16). The ascent of the Uaupes (more generally known by the Indians as Caiary) was begun on August 4, and after some forty rapids had been surmounted, the Cuduiary, one of the most important left-bank tributaries, was reached on September 21. Everywhere the reception of the traveller by the various Indian tribes was most friendly. Continuing the voyage on October 9, Dr. Koch passed the Yurupary cachoeira, the last cataract of the Uaupes, and met with no more Indians, it being only with great difficulty that he was able to reach his goal—a settlement of Colombian "caucheros"—on the 30th. These people had only made their way to this district about eighteen months before from the Putumayo and Caqueta or upper Japura. Dr. Koch makes some forcible remarks on the shameful way in which the natives have been treated by these and other supposed representatives of civilization, which not unfrequently, he says, quite matches the atrocities committed by the early conquerors. The return journey again involved great hardships, many of the men being down with malarial fever, which prevails on this otherwise healthy river above the falls, owing perhaps to the stagnant white water. Reaching a settlement of the

Koteuas, on the Cuduiary, he ascended this stream for five days through a thickly populated district, and climbed to a plateau which seemed undermined with vast regular cavities. Dr. Koch gives some account of the various tribes of this region, which have hitherto led a retired existence away from their fellow-men. To the south, towards the basin of the Japura, he met with many tribes speaking a true Carib dialect.

AUSTRALASIA AND PACIFIC ISLANDS.

New Zealand.—The report for 1903–4 of the New Zealand Lands and Survey Department shows satisfactory progress in the way of mapping and defining areas and of the appropriation of the land. There were, in 1903–4, 2813 new selections comprising over 1½ million acres, an increase of 35,279 on the area of land selected in 1902–3; 432 of the selections were less than 1 acre each, and 166 reached 1000 acres and upwards, the average selection measuring 577 acres. Under the Village Settlement system there were, on March 31, 1904, 2014 settlers holding 43,146 acres, an average of 21¼ acres each. In view of the great shrinkage of land inviting settlement and other drawbacks, the record of land operations must be accounted satisfactory. The gross total of milling timber on Crown lands is estimated at 21,000 million superficial feet, Nelson district heading the list with a volume of about 6000 million superficial feet of all varieties, closely followed in order by Westland and Wellington. The Crown kauri timber in Auckland is found to be below former estimates, and as there are about thirty-six kauri mills clearing 144 million superficial feet per annum, in eight years the colony's supply of kauri would be exhausted. However, the timber of the rimu, matai, and totara forests in the north is now found far in excess of previous computations. The output of all the mills in the colony is estimated at 372 million superficial feet per annum, a rate which would clear away all the colony's timber in seventy years. On the other hand, over 6½ million trees were raised in the nurseries and plantations in 1903–4 as against 4 million in 1902–3. The total number of trees raised between 1896 and 1904, on an area now measuring 1040½ acres, was 18,293,682. The prison-labour applied to tree-planting has proved every way profitable, notably in a moral sense to the prisoners. The weight allowed to the claims of natural beauty may be gathered from the assignment of ample areas as scenic reserves. More particularly, in the highly picturesque south land it is proposed to preserve in native immunity no less than 2,772,440 acres, including the Sounds National Park of 2,500,000 acres. During 1903–4 triangulation continued more or less in abeyance owing to settlement requirements, but the surveyor-general urges the resumption of triangulation on a large scale. A full report of the magnetic work of the year is furnished by Mr. Skey. Particularly interesting is the reference to the joint work of the Hagley Park observatory and the Antarctic Expedition. Eight photographs of the most marked seismograms of the year are appended. In the northern part of the South island magnetic work has been suspended since February, 1904. A further three months' work by one officer is all that is now needed to complete the magnetic survey of the colony, the results of which would be of so great value as well to navigation as to pure science. The comprehensive report deals also with temperature, rainfall, sanctuaries for animals and birds, etc. Besides maps and plans, there are numerous illustrations of scenery, flora, fauna, etc. The report of the minister of railways shows the railway mileage of New Zealand as 2328.

POLAR REGIONS.

The Duke of Orleans' Cruise in the Arctic Seas.—The Duke of Orleans sailed from Christiania on board the *Belgica*, the ship of the late Belgian Antarctic

Expedition, on May 6 last. The *Belgica* is commanded once more by Lieut. de Gerlache, and it is hoped that some scientific work will be done during the cruise, two scientists, Dr. Recamier, and Mr. Koefoed from the Bergen biological station, having joined the ship. The researches to be carried out will be made in connection with the International Commission for the exploration of the northern seas, and the lands at which it is expected to touch are Jan Mayen, East Greenland, Spitsbergen, and Franz Josef Land. A look-out will be kept for news of the Ziegler Arctic Expedition.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Origin and Growth of Ripple-mark.—The *Proceedings of the Royal Society* for April 10, 1905 (vol. 74, No. 506), contain the abstract of a communication by Mrs. Ayrton, describing experiments in regard to the origin and growth of ripple-mark, which were alluded to by Prof. Darwin in his lecture at the Cambridge Meeting of the British Association last year. The result of the experiments is to confirm the truth of the principle already recognized by other observers, that the prime cause in the formation of ripple-marks in a previously smooth surface is the variation in the rate of the current flowing over it; but they have added somewhat to our knowledge of the precise mechanism by which the given result is attained. Mrs. Ayrton found that a single ridge forms wherever the water happens to have the same place of maximum longitudinal velocity during several oscillations. That as soon as this ridge is high enough (less than a millimetre being sufficient) the water in flowing over it forms a spiral vortex with horizontal axis, which starts a new furrow and ridge in the lee of the first, the process being continued until the whole sand is ripple-marked. It was also found that "ripple vortices" came into existence only during the time when the water was rising above the mean level. In cases where the maximum horizontal velocity remained in the same place for a considerable time, as at the loop of a stationary wave, the ridge was found to grow into a ripple-marked heap, which was highest at the loop and lowest at the nodes. While not bringing to light any new principle, these experiments are useful for the support they give to conclusions reached otherwise on theoretic grounds.

The Origin of "Nieves Penitentes."—In spite of the many attempts, some of them more or less satisfactory, which have been made to explain the mode of origin of the well-known *nieves penitentes* of South America, the phenomenon continues to exercise the minds of physical geographers, and several new discussions of the question have lately appeared. Some of these contain suggestions which may help towards a fuller elucidation of the details of the problem, though the general principle—put forward independently, a few years back, both by Prof. Hauthal and Sir Martin Conway—that the primary cause is the differential action of the solar radiation, does not seem to be invalidated. In the *Sitzunsberichte* of the Munich Academy of Sciences (*Math. Phys. Klasse*, 1904, Heft III.), Prof. S. Günther calls attention to the close similarity between the *penitentes* and earth-pyramids, and argues that this must be due to a similarity of origin. He enters somewhat fully into the causes to which earth-pyramids are due, holding that the capping by a stone or rock, though no doubt exercising a protective influence, is by no means of fundamental importance, but that the true cause is the dissection of a deposit of loose material by running water, first into continuous ridges, and afterwards (by an extension of the process) into single pyramids. This, too, he supposes to have been the mode of formation of the *penitentes*, their arrangement in regular rows being thus accounted for. To explain this regularity of arrangement, Prof. Deecke (*Globus*, vol. 87, 1905, No. 15) has

recourse to a supposed wave-formation induced on the surface of the snow by wind, giving an instance of a somewhat similar phenomenon observed by him in Europe in the case of snowdrifts thrown into wave-like forms and subsequently compacted by freezing. But against this is to be set the statement that the *penitentes* are usually found in spots sheltered from the wind. Perhaps the most ingenious explanation of the whole phenomenon is that suggested by Curt Facilides, in the *Mitteilungen des Deutschen und Oesterreichischen Alpenvereins* (1904, No. 21). This writer considers especially (1) The regular arrangement in parallel rows, directed in the Andes from north-west to south-east; (2) the limited zone of latitude within which the phenomenon has been observed. As regards the first point, he holds that the true cause is the shadow cast by the irregularities in the surface of the ice during the limited space of time (12 to 3 o'clock) in which the solar radiation is powerful enough to exercise much influence. The larger irregularities will, by their shadow, protect those lying behind them in the direction opposed to the sun, while the smaller will melt the sooner, thus exposing to the effects of radiation those lying behind in a similar direction. (It may be remarked that in any haphazard arrangement of such irregularities, there will always be certain systems running in a given direction, and in the case of these the protective influence of the shadows would, no doubt, be especially operative.) If this explanation is correct, it supplies a reason also for the limitation of the phenomenon to a definite zone of latitude, for not only must the elevation of the sun at noon reach a certain minimum, but there will be also a maximum beyond which the shadows thrown will be too small to have the supposed effect. It is, however, to be remarked that a formation closely resembling the *penitentes* has lately been observed by Prof. Uhlig on Kilimanjaro (*Zeits. Ges. Erdk. Berlin*, 1904, p. 632), so that the phenomenon would not seem excluded from the equatorial zone. This observer seems inclined, like Prof. Günther, to attribute the linear arrangement to the action of the water-runnels, which would follow a direction parallel to the slope. These two writers likewise agree in distinguishing the *penitentes* from the *Karren* formed on the surface of glaciers, though while Prof. Günther says that the former are really formed in ice, not snow, the latter, like Sir Martin Conway, speaks of the substance in question merely as hardened snow.

Bird Migration: Dates of Arrival.—During the preparation of a work on bird migration, Dr. Koepert, of Dresden, has bestowed much attention on the dates of arrival of summer visitors at their nesting-places in Germany, and the special causes which determine them. He gives the results of his study in a recent number (1905, No. 8) of the *Naturwissenschaftliche Wochenschrift*, published at Jena. After pointing out that the date of arrival is progressively later as the latitude and altitude increase, he says that this is not due, as might at first sight be thought, solely to differences of temperature, as evidence exists for the power of birds of warm climates, owing to their feathery covering, to stand a considerable degree of cold, provided their food-supply is maintained. In tracing the relation of the date of arrival to the temperature of different places in Germany, he finds that the available direct observations of temperature do not suffice for the purpose, and therefore has recourse to the phenological observations made of late years in regard to vegetation, which is, of course, closely dependent on temperature. Taking first the case of the nightingale, he finds an almost entire agreement between the date of arrival and the advance of vegetation in various localities, and while allowing that this may in part be due to the need of a screen of vegetation for nesting purposes, he considers that the determining factor is the appearance of the lower organisms of the animal kingdom, which form the food of the birds, such appearance itself depending on the awakening to life of the vegetation. These

conclusions are only what might have been arrived at by *a priori* reasoning, but it is useful, no doubt, that they should be fortified, as is done by Dr. Koepert, by exact data. It may, perhaps, be asked whether enough weight is given to the simple factor of the distance to be traversed between the winter and summer home, which must, of course, exercise some influence, though it does not account for the retardation due to elevation. Also it must be allowed that temperature exercises a direct influence, in so far as the growing warmth of the winter habitat must, in part at least, supply the impetus for the migration, though this will be also due to the instinct to seek the original home for breeding purposes.

GENERAL.

Captain Scott and Sir F. Younghusband at Cambridge.—Among the degrees conferred at Cambridge last month *honoris causa*, were those given to Captain Scott and Sir Francis Younghusband, who both received the degree of Sc.D., their services to the cause of knowledge being described in suitable terms by the public orator.

The Oxford Geographical Scholarship, 1905.—An examination for one scholarship of the value of £60 will be held on October 12 next. Candidates, who must have taken honours in one of the final schools of the University, should send in their names to the Reader in Geography, Old Ashmolean Museum, not later than October 2.

Award to Dr. Vaughan Cornish.—The International Jury of the St. Louis Exposition have awarded a silver medal to Dr. Vaughan Cornish, F.R.G.S., for his photographs of waves in water, sand, and snow.

The Earliest Cartographer of the North.—In May, 1904, Dr. Axel A. Björnbo delivered a lecture before the Norwegian Geographical Society on Claudius Claussön Swart, or, as he is more frequently called, Claudius Clavus Niger. He was born in Denmark in the year that war broke out between Queen Margrethe and King Albrecht (1388), and was educated in a monastery school, probably in Sorö. About 1412 he left his native country, and the winter of 1423–4 he spent in Rome, where he made the acquaintance of the papal secretary, Poggio. An early map of Clavus was discovered in 1835 at Nancy, which showed a great improvement over earlier maps, and contained Greenland and Iceland. It was accompanied by a description in manuscript. Subsequently it was discovered that two German geographers of the beginning of the sixteenth century had quoted Clavus, but their citations, though agreeing together, were not in accordance with the Nancy manuscript. In 1888 several hand-drawn maps were found in Warsaw and Florence which showed a resemblance to the Zeno map of 1558, which Zeno the younger declared to have been drawn after a map of about 1380. Dr. Björnbo relates the discussions that ensued, and how he himself proved, by the discovery of a manuscript at Vienna, that Clavus was the author of the map, having acquired better information after the compilation of the Nancy map, and having travelled up the coast of Norway. This was the best map of the northern countries until the appearance of those of Ziegler and Olaus Magnus in 1532 and 1539, and as regards Greenland its influence may be traced far into the seventeenth century.—*Det Norske Geogr. Selskabs Aarbog*, 1903–4.

OBITUARY.

Obituary of the Year.

The following is a list of the Fellows who have died during the year 1904-1905 (April 30):—

W. M. Allport; J. N. Arthur; J. W. Anderson; Chas. H. Allen; Wm. Allen; Captain C. Alexander; Sir E. F. Alford; H. P. Brandreth; Rev. G. J. Bridges; W. A. Browne; Sir Michael Biddulph; Major G. H. Bretherton; Mrs. Bishop; Major-General R. C. Brooke; Captain E. P. W. Browne; Geo. J. Bridges; E. L. Boyd; Sir W. L. Booker; Lieut. Bacon Habel; General J. Bayly; Hon. O. Borthwick; The Earl of Bective; Dr. A. Bastian; H. E. Charlesworth; G. M. Courage; W. Chapman; John Cohen; Wm. Cotesworth; James Campbell; General A. C. Cooke; Sir John Doran; John Dale; Hon. John Douglas; E. M. Denny; Colonel C. A. W. Finch; Frederick Gahan; Robert Gordon; Rev. M. Galbraith; H. R. Grellet; W. P. Goulding; Major E. Guinness; Captain H. E. Haynes; Count Hoyos; Captain Henderson Smith; Henry Hansard; J. A. Jones; W. J. Johnston; Captain E. T. James; Sir Francis Jeune; Colonel W. W. Knollys; N. W. Levin; Lieut. F. G. I. Lillingston; R. Lloyd Jones; Wm. May Lindsay; Sir John McNeill; James Macbraire; W. G. Macgregor; Sir D. H. Macfarlane; Canon A. P. Moor; Dato James Meldrum; R. B. Moorhead; F. D. Mocatta; G. J. Morrison; Frank McClean; J. G. Meggs; Field-Marshal Sir H. W. Norman; Lord Northbrook; T. W. H. Oakley; Admiral Sir Erasmus Ommanney; T. F. Perrott; Campbell Praed; Wm. Hy. Potter; Captain H. A. F. Plater; Dr. R. A. Philippi; Admiral J. C. Purvis; E. J. Payne; Frank Russell; Frederick Ratzel; C. Boyd Robertson; Eli Sowerbutts; Sir H. M. Stanley; Wm. John Sharpe; Hugh Stowell Scott; Colonel C. E. Stewart; C. P. Serocold; The Earl of Southesk; Stephen Wm. Silver; J. Henwood Thomas; General Sir Richard Taylor; Joseph Tucker; James Lewis Thomas; Baron Toll; Theodore Uzielli; Charles Winnecke; Dudley Alex. West; R. Willis; Dr. A. Blair Watson; Stephen Wand; Captain W. G. White; Leedham White; John A. Woodall.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1904-1905.

Anniversary Meeting, May 22, 1905.—Sir Clements Markham, K.C.B., F.R.S., President, in the Chair

The Secretary read the minutes of the last Anniversary Meeting, which were confirmed and signed by the Chairman.

The Secretary read a list of the newly elected Fellows of the Society.

Elections:—*Sir Robert Edward Bredon, K.C.M.G.; Cecil Clementi, M.A; Leonard Victor Dalton; Frederick Wm. Grantham; John Frederick Oiesen; Captain Hugh D. E. O'Sullivan, R.M.*

The presentation of awards then took place.

The President: Sir Martin Conway, the Council have felt that your numerous services to geography fully deserve one of the Gold Medals of the Society, and His

Majesty the King has approved of the selection. The Council are fully alive to all your valuable Alpine work and your exploration of the Mustag Himálaya. Your examination of lofty passes and glaciers shows how much can be done by the courage and ability of a private explorer under the most difficult circumstances. You returned with a large-scale map as a result of a most interesting journey. You then turned your attention to Spitsbergen, and you were not content with going in the old tracks and following the coast-line, but you determined to explore the interior and to give us a knowledge of it, and you did that successfully. But what is to be admired most, I think, is that you combined research with your explorations, the evidence of which is the volume which you edited for the Hakluyt Society, and your bibliography, and a most interesting and valuable geographical work on early whaling, Dutch and English, and on the Russian fishermen in Spitsbergen, which we all hope will be soon issued through the Cambridge Press. Next you turned your attention to South America, to the Bolivian Andes, and attacked the great peaks of Illimani and Illampu, making a careful survey, which added very largely to our knowledge of that part of the Andean region. Nor did we forget your ascent of Aconcagua and your attempt on Mount Sarmiento in Magellan straits, so that your services to geography have been cumulative and have been performed in many regions. It gives me very great pleasure to place in your hands the Founder's Medal.

Sir MARTIN CONWAY: It would be false modesty on my part if I were to profess indifference, or anything short of exceeding pleasure and gratitude, at the receipt of this medal which has been given to me to-day. It adds enormously, I think I may be believed when I say, to the pleasure of receiving it, that I do so at the hands of Sir Clements Markham, as one of the last actions of his distinguished presidency. I must add that in receiving it I feel how large a share of such merit as has been earned belongs not by any means to me, but to the loyal helpers and companions I had in my various journeys. Certainly no traveller more than I, I think, has been so dependent upon the assistance that he has received from his companions, and I would not like to sit down without especially mentioning the name of my excellent and valued friend and colleague in my Himalayan journey, Major Bruce, of the 5th Ghourkas; certainly without him that journey would never have accomplished such success as it attained, and in receiving from the hands of your President this testimony, I accept it fully as much as a testimony to him, in so far as it applies to the Himalayan journey, as to myself.

The PRESIDENT: Major Ryder, when we heard of the work you were doing in Tibet we felt that the other Gold Medal of the Society was due to you, and His Majesty the King has approved of our choice. I think it is more than ten years since you began your geographical surveys, when you were with our lamented friend Colonel Woodthorpe on the Mekong Boundary Commission. You then served in Yunnan with Major Davis, and did an enormous amount of valuable survey work, and afterwards with the expeditionary force in Northern China, when you were present at the relief of Peking, and again did valuable survey work. But of course the great interest of your services is in Tibet, when you were under the orders of Sir Frank Younghusband and General Sir Ronald Macdonald, and you have, by an excellent survey, connected British India with the famous city of Lhasa. You have made large-scale plans of Lhasa and Gyantse, and after parting company, when you went on with Captain Rawling, you did most valuable and interesting survey work along the whole of the course of the Sanpu to its source, where no Englishmen have ever been before, and you finished with exceedingly interesting and valuable work on the Gartok branch of the Indus and the source of the Satlej. We all think that in giving you this medal at your age you will be sure

to wish to do more, and it will be a certain incitement to you to undertake further work on behalf of geographical science. I have much pleasure in placing the Patron's Medal in your hands.

Major C. H. Ryder: I thank you most warmly for this medal, which I, in common with all explorers, look on as the blue ribbon of an explorer's life. In all the journeys that I have had the good fortune to make, I have been, first of all, extremely fortunate in the officers under whom I have had the honour to serve. In Yunnan, in the two years' exploration that I undertook there, I was under Major Davis, who is an expert in Western China, and during the time I was in Tibet I was under Sir Frank Younghusband and Sir Ronald Macdonald, both of whom have always taken the warmest interest in geographical work. Also I have been most ably assisted throughout my work by many officers and surveyors, particularly Captain Wood and Captain Cowie and many native surveyors who have always assisted me in the most able manner. I am particularly glad to have been able to do this work in Tibet during the time that you have been President, sir, as we all know the very great interest that you have taken in Tibetan work. At the same time, I hope I may have the good fortune at some future period to wander about the world somewhere else.

The President: Mr. Bartholomew, it has been, since I have known it, the desire of this Society to recognize the valuable work of geographers at home as well as the important work of geographers abroad. My old friend and revered predecessor, Sir Roderick Murchison, felt this very strongly. He presented one gold medal to Mr. John Arrowsmith, and another to Mr. Augustus Petermann, and he selected Mr. A. K. Johnston for another when he was struck down with his fatal illness. As a matter of fact, Mr. A. Keith Johnston received the medal from Sir Henry Rawlinson. Our Council has always desired to follow Sir Roderick's excellent example, and has instituted a special medal for research. When our revered sovereign Queen Victoria died, we were very loth to lose her effigy from our medals, and this medal for research was consequently instituted as the Victoria Medal. With perfect unanimity, the Council has felt that your great merits deserve recognition in the form of our Victoria Medal. By your important work, and especially by your beautiful atlas of Scotland, by your survey atlas of England, and by the first volume of your great physical atlas, you have certainly raised the standard of cartography in this country, for you have not only striven, and striven successfully, to produce very beautiful and graphic execution on your maps, but you have also during many years occupied yourself in geographical and statistical research, so that we feel that you are not only a very eminent cartographer, but also a scientific geographer. In both these capacities, I have very great pleasure in presenting to you the Victoria Medal in the name and on behalf of the Council of this Society.

Mr. Bartholomew: So far as honours go, I have always regarded the Victoria Medal of the Royal Geographical Society as the summit of a cartographer's ambition. I can certainly assure you, sir, that no honour could be more appreciated by me than this most gratifying recognition of my work, and to receive this recognition whilst still in the enjoyment of one's full working powers is a very great encouragement to further effort, although in cartography, as in everything else, one's highest effort must always be inspired by ideals. Whatever the progress of cartography may have been in the past, there is undoubtedly great scope for its development and improvement in the future, and it is certain that our efforts towards the promotion of geographical education in the universities and schools of this country must soon lead to the appreciation of a much higher standard of work. When I think of the famous geographers who have received

this same medal in the past, from Carl Ritter down to Arrowsmith, Keith Johnston, Reclus and Ravenstein, it would almost seem to reflect upon us at the present day that we have not achieved more in mapping the varied phenomena of our globe. But progress cannot be rushed; we must necessarily take public education with us. On this occasion, however, I feel I should be a most unworthy son of my patronymic ancestor, Ptolemy, the first map-maker, if I did not claim for cartography its fullest measure of importance—I would certainly go the length of saying that it would be greatly to the advantage of this country if we had a wider application of cartographic methods to the demonstration of all its problems —to its vital and economic statistics, its trade, agriculture, public health, and all questions affected by geographical environment. I would even venture to say that if most of our ponderous Blue Books were reduced to cartographic summaries, they would be much better understood and appreciated. Further, if this work is worth doing for any one country, it is doubly worth doing on an international basis. We must realize that true geography is nothing if not cosmopolitan, and I earnestly trust that the International Committee of Cartography appointed last year at St. Louis may be fruitful of suggestions in this direction, especially as regards the unification of international cartographic methods. In tendering my very cordial thanks to your Council for this medal, I would like to add, sir, that to me its value is greatly enhanced by receiving it from your hands at the close of your long and distinguished Presidentship of this Society.

The PRESIDENT: The Murchison Grant has been awarded to Mr. William Wallace, who has done such important geographical work in Nigeria, and read us a very interesting paper on the subject. The Back Grant has been awarded to Captain C. Maud, for his valuable work connected with the examination of the southern borders of Abyssinia. The Cuthbert Peek Grant has been awarded to Mr. Francis J. Lewis, for his valuable contribution to our knowledge of botanical distribution in the north of England. He has chosen to take it in the form of a field-glass. The Gill Memorial has been awarded to Colonel Maunsell, for his explorations during many years in Asia Minor, and for the valuable map he has presented to us. It will take the form of a silver cup.

The President then delivered his anniversary address (see p. 1).

The Report of the Council was then read; it will be published in the next Year-book. The President announced that, as a result of the ballot, the Council as proposed had been duly elected. The list is as follows, the names of new members, or of those changing office, being printed in *italics*:—

President: *Right Hon. Sir George D. Taubman Goldie*, K.C.M.G., F.R.S., D.C.L., LL.D. *Vice-Presidents*: Sir H. E. G. Bulwer, G.C.M.G.; Colonel G. Earl Church; Colonel Sir Thomas Hungerford Holdich, K.C.M.G., K.C.I.E., C.B., R.E.; *Colonel D. A. Johnston*, C.B., R.E.; *Sir Clements R. Markham*, K.C.B., F.R.S., F.S.A.; Sir George S. Mackenzie, K.C.M.G., C.B. *Treasurer*: Edward L. Somers Cocks. *Trustees*: Right Hon. Lord Avebury, D.C.L., F.R.S.; Lord Belhaven and Stenton. *Hon. Secretaries*: Major Leonard Darwin, R.E.; James F. Hughes. *Foreign Secretary*: Sir John Kirk, K.C.B., G.C.M.G., F.R.S. *Councillors*: *Admiral Sir Nathaniel Bowden-Smith*, K.C.B.; Admiral Sir James Bruce, K.C.M.G.; J. Annan Bryce; Major Chas. F. Close, C.M.G., R.E.; Prof. J. Norman Collie, F.R.S.; Captain Ettrick W. Creak, C.B., F.R.S., R.N.; *Douglas W. Freshfield*; Prof. E. J. Garwood, F.G.S.; F. H. H. Guillemard, M.A., M.D.; *Sir Clement L. Hill*, K.C.M.G., C.B.; D. G. Hogarth, M.A.; Sir Harry H. Johnston, G.C.M.G., K.C.B.; Admiral Sir Albert Hastings Markham, K.C.B.; *Right Hon. Sir Joseph West Ridgeway*, K.C.B., G.C.M.G., K.C.S.I.; *Major C. H. D. Ryder*, R.E.; *Captain R. F. Scott*, C.V.O., R.N.; Colonel Sir Colin C. Scott-Moncrieff, K.C.M.G., C.S.I., R.E.; General J. H. M. Shaw Stewart, F.R.S.E., R.E.; *Colonel Hon. M. G. Talbot*, R.E.;

Colonel Sir Henry R. Thuillier, K.C.I.E., R.E.; Commander David Wilson-Barker, R.N.R., F.R.S.E.

After the announcement, the PRESIDENT said: I now have the pleasing duty of announcing that the Council's list has been unanimously adopted, including Sir George Goldie as your President. Sir George Goldie is well known to us all as the able administrator, the great promoter of geographical exploration, and the founder of Nigeria. He has been a Fellow of this Society for twenty-eight years, a member of our Council for fourteen years, and Vice-President for nine years. He is, therefore, well acquainted with your business. He has qualifications, as a councillor, which I do not possess. I am indebted to him for advice and help of such value and importance that I am quite unable sufficiently to express my gratitude to him. I congratulate the Society on the acquisition of so very able a President, who will be devoted to its interests.

Sir THOMAS HOLDICH: I wish to say a very few words with reference to what Sir Clements Markham has told us about the necessity that he feels for resigning the high position of President and being succeeded by Sir George Goldie. They will be very few words, for this is not the place to enter into a history of Sir Clements Markham's long connection with this Society; besides, I think the record of the work that he has done in that connection is to be found pretty amply in the chronicles of the Society itself: I believe that there are, at least, twenty-four volumes of the *Journal* of the Society which are full of them. But what I wish to say specially from the members of the Council, and I think for all those who are here, is this—that when Sir Clements leaves that chair we shall miss him—we shall miss him sorely from the accustomed place. Other men may come, and will come, and they will give us some of their time, no doubt, and the best of their ability towards solving the complicated problems which continually come before the Society; but it will not be quite the same thing, for Sir Clements' connection with the Society has been something more than heart-whole—it has been almost life-whole. With him it has been the Society, the whole Society, and nothing but the Society; and in these busy days we can hardly expect that from anybody else in future. But I think that if Sir Clements looks back over the twelve years during which he has been President, he can see for himself what has been done during that time; indeed, he has recounted some of it to us just now—he will see that the Society is now placed quite first amongst all Geographical Societies of the world; high in the estimation of all scientific people as an educational factor in England; and he will certainly be proud of his work; whilst we, looking back over the same time, may fairly say that we are proud of our President. Taking it for all in all, we are not likely to see another quite his equal. His name will ever be connected with the best and the brightest annals of the Geographical Society; and I will only add that whilst we all seriously deplore that there should be reasons which lead him to resign his position as President, and although we shall miss his steady hand at the helm and his constant watchfulness over the course which our ship is steering, yet still we hope to have the benefit of his advice, that advice which is always so freely and so frankly given to anybody who asks it, and his counsel, which is a counsel matured by a long experience and probably an unequalled acquaintance with all the varied interests of this great Society.

Colonel FEILDEN: I am sure all present, both Fellows and visitors, will agree with the tribute of Sir Thomas Holdich to our President. I was told that I was only to speak for one minute, and that is a very short time in which to say what I should like to, for if I had my own way I should speak far longer in regard to Sir Clements Markham. I shall not venture to say anything of his incomparable

services to geography; but there is one phase of his many-sided character which I should like to refer to, and that is not only in the Council room and in the whole working of the Geographical Society, but in his more private life. When any young traveller, or any one willing or desirous of obtaining information, applied to Sir Clements Markham, there was no one in the world so willing to give it as our President, and no labour seemed to prevent him doing so. I have had the honour of Sir Clements Markham's acquaintance for over thirty years, and during that time, whenever I was at a loss and could not find what was wanted in the Encyclopædia Britannica or the Century Dictionary, whatever the point might be, geography, genealogy, historical records, or almost any subject, I applied to Sir Clements Markham, and I invariably, by return of post, received a reply, and a satisfactory one. I beg to offer our sincere feelings of respect and regard to our President.

Sir Clements Markham: I have been deeply touched by the way you have received the two speeches from such very old friends, both of whom I have known for very many years, one from the Arctic Regions and one from the Tropics. They, of course, have drawn a picture without any shadow in it, which is not very artistic. Still, it is extremely kind of them to say all they have, and I feel it very deeply. I also feel the kindness with which you have received their speeches.

BANQUET TO SIR CLEMENTS MARKHAM.

On the evening of the anniversary, May 22, a banquet was given by the Fellows of the Society in honour of the retiring President, Sir Clements R. Markham, K.C.B., F.R.S. The new President, the Right Hon. Sir George Taubman Goldie, K.C.M.G., and about three hundred were present. Among those present were the following: The Earl of Camperdown; Lord Eustace Cecil; Lord Belhaven and Stenton; General Lord William Seymour; Lord Colchester; Admiral of the Fleet, Sir F. A. Richards; Admiral Sir Walter Hunt Grubbe; Admiral Sir Vesey Hamilton; Prof. Henri Cordier, representing the Paris Geographical Society; Colonel Sir Thomas H. Holdich; Admiral Hon. Sir E. R. Freemantle; General Sir Richard Harrison; Admiral the Hon. Sir A. Cochrane; Admiral Sir Albert Markham; Sir Frank Younghusband; Sir Montagu Ommanney; Sir George S. Mackenzie; Sir W. R. Anson; Sir Henry Bulwer; Agent-General for New South Wales (Hon. T. H. Coghlan); Agent-General for New Zealand (Hon. W. P. Reeves); Agent-General for Queensland (Sir Horace Tozer); Agent-General for Victoria (Hon. J. W. Taverner); Admiral C. R. Arbuthnot; Sir W. T. Thiselton Dyer; Sir Colin Scott-Moncrieff; Mr. G. E. Buckle; Major C. H. D. Ryder; Sir Martin Conway; Mr. A. B. Kempe, Treasurer for the Royal Society; Colonel H. W. Feilden; Rt. Hon. W. Ellison Macartney; General Sir Ronald Lane; Captain R. F. Scott; Archdeacon of London; Colonel Sir George Leach; Sir J. G. Scott; Prof. James Geikie, President of the Scottish Geographical Society; Sir A. Moloney; Mr. Anthony Hope Hawkins; Sir Harry Johnston; Dr. Gow; Dr. Blyden; Colonel G. Earl Church; General Shaw Stewart; Mr. Maw, President of the Royal Astronomical Society; Mr. Yates Thompson; Mr. J. Annan Bryce; Mr. Fabian Ware; Dr. W. T. Blanford; Colonel E. S. Milman; Mr. Hugh Chisholm; Mr. Douglas W. Freshfield; Colonel C. E. Yate; Captain C. G. Rawling; Major Leonard Darwin; Mr. J. F. Hughes; Mr. Edward L. S. Cocks; Colonel C. M. Watson; Colonel A. J. Arnold; Mr. J. G. Bartholomew; Major C. F. Close; Mr. H. J. Mackinder; Mr. Reg. J. Smith; Colonel Le Messurier; Sir Ernest Clarke; Lieut. Skelton; and the staff of the Society.

In the intervals between the toasts, a programme of music (quartettes and solos) was performed.

In proposing the toast of "The King," the PRESIDENT said: Sir Clements Markham, my lords, and gentlemen, I rise to propose the toast that always stands first at gatherings of this kind throughout the empire. But before doing so I wish to read a letter from Sir Dighton Probyn which Sir Clements Markham has handed to me. It is dated May 20, and addressed to Sir Clements Markham—

> "I am commanded by His Majesty to say it is with regret he learns that you feel you must resign the office of President of the Royal Geographical Society. The King commands me to add that he, as Patron of of the Society, cannot allow you to retire from the Presidency without thanking you for and congratulating you on the able, zealous, and very successful manner in which you have conducted the arduous and important duties connected with the Geographical Society during the twelve years you have been at its head."

I think it would be unbecoming of me to add any remark of my own beyond expressing the gratitude of the Royal Geographical Society to their Patron, His Majesty the King, for the graceful and appreciative way in which he has caused the letter to be written to our twelve-years' President, Sir Clements Markham. I therefore give you at once the Toast, "His Majesty the King."

In proposing the Toast, "Her Majesty the Queen, H.R.H. The Prince of Wales, The Princess of Wales, and other Members of the Royal Family," the PRESIDENT said: My lords and gentlemen, I now rise to give you the second loyal toast, and it is, "Her Majesty the Queen, H.R.H. The Prince of Wales, The Princess of Wales, and other Members of the Royal Family." But here again I have a letter to read, also handed to me by Sir Clements Markham. This is written by Sir Arthur Bigge, who says—

> "DEAR SIR CLEMENTS MARKHAM,
>
> "The Prince of Wales desires me to tell you how much he regrets to learn from the newspapers that you are about to resign the office of President of the Royal Geographical Society, which position you have held with so great distinction for many years."

I think I need not add any remark excepting that we receive the expressions of our Vice-Patron with the same gratitude as we received those of his illustrious father. I beg to give you the toast.

The PRESIDENT next proposed the toast, "The Guest of the Evening, Sir Clements R. Markham, K.C.B., F.R.S.," and said: My lords and gentlemen, it has been the unbroken custom of the Royal Geographical Society for more years than I can remember, and I believe, on good authority, from time immemorial, to commemorate its foundation by an Anniversary Dinner held on the day, which is to-day, of the Anniversary Meeting. For once that commemoration is in abeyance. We have met here to-night to do honour, not to an institution, but to a man—our guest of the evening, Sir Clements Markham. And as it is my privilege, my sad privilege, because I—but you will understand—have to propose his health, it also devolves upon me to place on record the reasons that have impelled us to this exceptional, this unique, departure from our time-honoured custom. I cannot do this without reviewing to some extent the long and varied career of our distinguished guest, and yet I feel that I must not overstep too far, even on this special occasion, the limits which the progress of civilization has imposed on after-dinner speeches. My only resource is to follow the methods of those who I understand are known in other halls as "lightning artists." I must also, to my great regret, but after careful consideration, exclude from any notice whatever the

numerous distinguished and well-known persons—some of them are dining with us to-night—with whom Sir Clements Markham has served, or who have served under his instructions, or who have collaborated with him in any of his undertakings. My sketch, however meagre, must be a personal portrait and not a panopticon of celebrities. Every Yorkshireman in this room, and I have seen some here, knows that Sir Clements Markham comes of a good old family of that county which has given us a champion cricket team and a champion geographer. Every old Westminster here will have fresh in his mind the references to Sir Clements Markham in the Epilogue of last December; but he must be a really old Westminster if he remembers, what I discovered in a book, that so far back as 1867 Sir Clements Markham—or, as he was then, Mr. Markham—was already so famous that he received similar humorous notice in the prologue of the Westminster play of that year. And every naval officer here—there are a good many—will remember that it was as a midshipman in the Royal Navy that our guest took part in the Arctic Expedition of 1850–51. He has just told me with a genuine air of regret that, owing to his being a junior officer—I think he called himself the "Boots" of the expedition—he was only allowed to go for forty-five days' sledge travelling. I should imagine that forty-five days' sledge travelling would be enough to nip in the bud the affections of most people for Arctic travelling. But we know that his were not affected, because we find that twenty-three years later he actually applied for and obtained special leave from the Secretary of State for India in order that he might accompany as far as Greenland—they could not allow him to go further—the Arctic Expedition of 1875. For the last few days I have been taking special interest in Sir Clements Markham, and on Saturday morning I read through his contribution to the *Proceedings*, or what we now call the *Journal*, of the Royal Geographical Society some thirty years ago, describing that most interesting voyage to Greenland and back in the *Alert* and the *Valorous*. I can recommend it to your notice. It is extremely interesting, and I took the trouble to note down the reference; it is p. 55, vol. 20 of the *Proceedings*. There can be no doubt that to the very early affection acquired by Sir Clements Markham for polar exploration we are in part indebted for his having, between forty and fifty years later, initiated and carried through that National Antarctic Expedition to which I must refer presently. After some eight years' service he passed for his lieutenancy, and then left the navy. He has not told me why. I know why, by experience. He had a passion for exploration. Having left the service, he went off to South America and explored there for two or three years, chiefly in the forests east of the Andes. After that he entered the India Office, where he remained for twenty-three years; but when I say he remained there, that is only a figure of speech. His soul was not fettered to an office stool, and he appears to have entirely disregarded the advice of Sir Joseph Porter in H.M.S. *Pinafore*; for instead of sticking close to his desk and never going to sea, Sir Clements Markham seems to have been constantly going to sea and exploring distant lands in the service of his country. I cannot closely follow him in his extensive travels; but as he had, for the moment, turned his back on "Greenland's icy mountains," we are not surprised to find him on "India's coral strand," while the breadth of his survey of mankind is perhaps best expressed by the title of one of his many publications, 'From China to Peru.' But perhaps I ought to mention that this particular work of his, 'From China to Peru,' did not describe his own travels. I have been talking to him about it during dinner. It was a question of introducing Chinese coolies into Peru, so that it is quite clear that Sir Clements Markham was the forerunner of Lord Milner. As I have mentioned his publications, let me diverge for a moment, lest I should forget, and let me draw your

attention to one of the leading characteristics of our guest to-night—I mean his remarkable and perennial literary activity. I take it for granted that every Fellow of the Royal Geographical Society knows about (one could not expect him to be conversant with) the stream of publications that has come from Sir Clements Markham's pen on geography and cognate subjects, during the forty-three consecutive years he has been a member of our Council, or the fifty and more years he has been a Fellow of our Society. Books, pamphlets, articles, essays, reviews; their name is legion. But the literary world knows that he has not confined himself to these geographical subjects, but that he has dealt, equally effectively although less extensively, with many other matters. I may mention history, biography, memoirs, grammars and dictionaries of little-known languages; but the bibliography of Sir Clements Markham might occupy an evening to itself. I am not sure whether I ought to remind a learned Society that he has written a romance. But I may say in extenuation that it is a quasi-historical romance, and a patriotic romance, because it deals with the supposed adventures of those slaves, *non angli, sed angeli*, whom Pope Gregory the Great saw in Rome. I may add that Sir Clements Markham was careful not to publish this novel until after he had been elected President; but in making this remark, I do not wish to discourage any distinguished novelist who may be present, and who may think that he carries in his pocket the baton of the presidency of a learned society. Well, gentlemen, I have dwelt on his literary activity, partly, of course, on account of the intrinsic excellence of Sir Clements Markham's writings, but also because it is the most tangible, the most visible outward sign that I can present to you of that inward fire, that restless energy, that untiring industry, which only those who have worked with him can fully appreciate. But all this is by way of parenthesis, and I must go back to his foreign travels. His greatest achievement at that time was the introduction from South America into India of the quinine-yielding cinchona tree. That work is so widely known that I need not dwell upon it beyond remarking that it occupied several years and a great deal of energy, and that it produced incalculable beneficial results to large sections of the Indian population. But, to my mind, his most interesting journey must have been when he went as geographer with the British army to Magdala, at the storming of which place he was present—I do not know whether he took an active part or not (I understand Sir Clements to say that he did not kill anybody) during the Abyssinian war of 1867-68. Deeply interesting from the geographical standpoint, because Abyssinia was in those days a very little-known country, but also interesting, I think, on account of the expedition itself, which to my mind has always appeared one of the best conceived, one of the best engineered, and therefore one of the least costly in blood and money, of all the British expeditions of the nineteenth century of the same magnitude and the same military success, although, unfortunately, from a political standpoint, one of the most fruitless, owing to the deplorably low ebb to which the imperial spirit had fallen during the apathetic sixties. Partly on account of the Abyssinian expedition, no doubt, but I suppose mainly for his general valuable service under the India Office, Mr. Markham received a C.B. in 1871; and this may be a convenient moment to remind you that he received his K.C.B. in 1896, that he has been the recipient of various foreign orders of distinction, and that the Congress of Peru voted him a gold medal; and, leaving these State decorations aside, that he is a Fellow of the Royal Society, that he has been the President of the Hakluyt Society for some fifteen years, and that he has received innumerable marks of approbation from many societies both at home and abroad. Yet I am confident that of all the honours that have been showered upon him, and which are not one-half of what he

deserves, there is not one that he values more highly, that he cherishes more deeply, than the Founder's Medal of the Royal Geographical Society. My confidence is based on the conviction that, although circumstances have led Sir Clements Markham into various occupations, he was really born a geographer. I do not think that he will deny the soft impeachment that geography has been the ruling passion of his life. And if a man is so fortunate, so happily balanced as to be able to live and move and have his being in the realms of science, I ask you what more attractive, what more valuable province could he choose to explore than the science dealing with this outer film of our globe, this thin film of land and air and sea where not only our own race, but where every sentient organism of whose existence we have any knowledge whatever, must dree its wierd? Born a geographer, Sir Clements Markham became a Fellow of this Society at the early age of twenty-four. Eight years afterwards he was elected a member of the Council, one of the youngest who has ever sat upon it, and the following year he was elected also to the position of Honorary Secretary, and he filled that post with great distinction for no less than a quarter of a century. In 1888, for some reason, he preferred to be re-elected only as an ordinary member of the Council. That lasted until 1893, by which time he had been for over thirty years a Member of the Council in one capacity or another, and for nearly forty years a Fellow of the Society. If at the end of that period Sir Clements Markham had abandoned the Society, an almost unthinkable hypothesis, he would even then have been handed down in its annals as a shining light; but those forty years were only a prelude to his taking possession of the promised land, for in 1893 he was elected unanimously to the chair, and he has been so re-elected to it year after year, as a matter of course, until this fatal afternoon, when to our inexpressible regret he retired on the unanswerable, the irresistible plea of need of rest. I am afraid that my remarks have a tendency to fall into the minor key of an obituary notice; but it is difficult to avoid a pathetic note in lamenting the official decease of an ideal President, especially when the speaker is an ephemeral successor to the office which he has seen raised to a standard that he cannot hope even to approach. Fortunately, the decease in question is only official, as we can see to-night. Unlike Mark Antony, I come to praise Cæsar—not to bury him; and as Sir Clements Markham, with true geographical spirit, has accepted a Vice-Presidency, he will be in a position, after a period of rest, to give to his successors the benefit, the immense benefit, of his experience and his advice. I shall not attempt this evening—I have spoken at great length already—to put before you any connected account of the services of our twelve years' President during the time that he was in the chair. In the first place, all that is modern history, and I assume that most of the Fellows of the Society are conversant with it. In the second place, Sir Clements Markham himself gave a brief account of his stewardship this afternoon at the Anniversary Meeting, which I hope a good many of you attended, while those who could not attend will find a report in the *Journal* of our Society; and I would especially draw their attention to that portion referring to the progress of education in this country, to the work which our Society has done in that direction, and to the fact that the two universities of Oxford and Cambridge have established schools of geography, each of which is partly subsidized and partly controlled by the Royal Geographical Society. But I have a third and better reason for not dealing with his Presidentship, and that is that I could not possibly condense into a few sentences any intelligible idea of the value of the services that he has rendered to geography in general, and to this Society in particular. It would serve no useful purpose if I read out a list, a sort of index, of the salient acts of his administration. You know as well as I do that administrative work

whether it is ruling an empire or a brigade or a battleship or a business, consists in the main, not of striking actions, but of innumerable details, and that success depends on the initiative, the knowledge, the care, and the persistence—I dwell especially on the persistence— with which those details are managed. Now, these are exactly the qualities that have so deeply impressed me in watching the work of Sir Clements Markham during his twelve years' Presidency. But there is one matter to which I must refer, because without it any sketch of Sir Clements Markham's life would really be like the play of *Hamlet* with the Prince of Denmark left out. I refer, of course, to the National Antarctic Expedition. I think that it is generally understood now throughout the country, not only that Sir Clements Markham initiated the expedition, but that he had, in the first place, to create that public opinion without which progress was impossible. From the day that he became President he took up the matter actively. For some years I used to watch, with admiration mixed with a good deal of scepticism as to the result, his efforts to procure the sinews of war. At last he got the money, thanks to one generous donor, to a large subscription of the Geographical Society, to a great number of smaller subscribers, and to a much-abused Treasury; and having got it, he threw himself heart and soul into the organization of the expedition, and neglected no detail, however minute, that could contribute to its success from the point of view of either geographical exploration or of scientific research, and no detail tending to minimize the risks to the health or lives of those concerned; and I think that his arduous work and anxiety must be almost compensated by the magnificent results achieved. But as the expedition is to form the subject of the next item on our toast list, I must not further pursue the topic beyond expressing the opinion that it has added to the laurels of the navy, to whose officers and men was entrusted the carrying out of the work; that it has been a genuine satisfaction to the nation, whose maritime primacy, whether naval or commercial, made it almost a duty, or, as Sir Clements Markham has often said, quite a duty, to establish its primacy of exploration in the Antarctic Regions; that it has been a source of legitimate pride to the Royal Geographical Society; and, finally, that it has been the crowning triumph of Sir Clements Markham's career. I think, perhaps, I have said enough to justify our setting aside an Anniversary Dinner on his behalf. There used to be a tacit convention in our Society that it would be little less than treason to suggest that any President could surpass, or even equal, Sir Roderick Murchison. I shall not attempt to weigh these two great geographers nicely in the balance. In the words of Dryden, "Let both divide the crown;" and I venture to prophesy that when the story of the first century of our Society's work comes to be written, the names of Murchison and Markham will be bracketed together as stars of the first magnitude. My lords and gentlemen, I fully decided before coming here to-night that I would speak only of Sir Clements Markham in his public capacities, because it seemed to me that in his presence and before so very large a gathering, most of whom cannot have had the advantage of working with him, and many of whom probably do not know him very intimately, it would be impossible for me to speak of him as a friend and as a colleague in the only way in which I could so speak of him. But it struck me that perhaps one short sentence might at any rate suggest the feelings in this direction of his co-workers, whether on successive councils of the Royal Geographical Society or among that admirable, that highly efficient permanent staff in Savile Row, who have so ably seconded his efforts, and that brief sentence is, that in quitting the Presidential chair he carries with him, not only our respect and admiration, but also our affection and our esteem. And I am confident that the Fellows of this Society scattered over the world will join in our fervent hope that

a period of rest will speedily restore his strength, and that he may be spared for many, many years to watch the satisfactory progress of that great Society on whose behalf he has so long, so ably, so strenuously laboured. I venture, then, on behalf of the whole body of the Fellows, those absent as well as those present, to call upon you now to receive with all honours the toast of the evening, "Sir Clements Markham."

Sir CLEMENTS MARKHAM, who was received with enthusiastic cheering and the singing of "For he's a jolly good fellow," said: My lords and gentlemen, Fellows of the Royal Geographical Society, I feel so overwhelmed with all your doings this evening that no words can sufficiently convey to you my thanks. Sir George Goldie has painted a picture with no shadows in it. Now, a closer examination might have enabled some of my friends, and certainly enables me, to see that there ought to be some shadows on that picture—many shortcomings and some mistakes that I have made. Sir George Goldie has most kindly taken such trouble to hunt up all that I have done that can be considered good, that he has forgotten to look at the other side. He is such a very old friend of mine that I cannot find fault with him for this. I consider Sir George Goldie to be one of the best colleagues I ever worked with. I valued his advice more, I think, than any one else's within the last twelve years. His counsel has been most valuable to me, has prevented me from making mistakes, and has enabled me to carry through most important work. I therefore feel that in all this country at the present moment no better successor could be found than Sir George Goldie. To-day I received a letter from the Viceroy of India, our Gold Medallist, who wished to congratulate the Society, not on my retirement, but on having found so very efficient a successor. Perhaps my associates will excuse me if I refer to my beginnings as a geographer for a minute or two. I do so because I am reminded of them by the fact that my old friend and shipmate, Lord William Seymour, is sitting on my right hand. It is due to his father, Admiral Sir G. Seymour, that I first seriously turned my mind to geography. We were on a very long voyage across the Pacific, and he sent for me and told me to make abstracts for him of all the useful points in Burney's voyages and in Captain Cook's voyages. Since that time I have certainly—it is a great many years ago now—considered geography the most charming and the most useful pursuit that could be followed. Well, a few years passed on, and with great trepidation I came to read my first paper at the Geographical Society. I found an unsympathetic audience, as I thought, and an unsympathetic chairman in the person of an old admiral. Just when I was having this feeling aroused in me, who should get up, to my utter astonishment, but Sir George Seymour, and the speech he then made put such heart into me that I continued with greater zest than ever my studies and pursuits connected with geography. I will not detain you a moment longer on that subject, but will turn to the duties I considered to be mine as President. One of those duties, and I think the most serious one, was to attempt to be impartial to the equator, to the south pole and to the north pole, and to every country—not to love one better than the other. I remember there was a girl, a bad girl, in one of Dickens's novels, and she was so rude as to say, "I hate Africa." Now, the President of this Society must hate no country; he must love them all. I am afraid that I have not succeeded altogether in that, but I have endeavoured to do so. And the next duty which I considered important was that I should encourage everybody to start on geographical expeditions. I have had an enormous correspondence on this subject. The last letter I received a week ago was from a stoker in His Majesty's service. I have had numerous letters from young clerks and all sorts of people, and I have invariably written them rather long letters in reply, urging them to abandon their work and

start on an expedition on the very first opportunity. Well, I have the great happiness to say that this conduct on my part has never weighed on my conscience, for it has led to no disaster. I wish to take the opportunity now offered me of thanking most warmly all the Councils of this Society who have helped me so strenuously, and with such a friendly feeling towards me, during the time I have been President. I also must remind you all that we not only have been working by ourselves in many parts of the world, but that we have had a great Society—the most ancient society in this country—joined with us to further Antarctic exploration. This is not the first time that we have had joint work with the Royal Society; we had a joint committee in 1875. It is a very difficult business, and after several experiments, we settled upon a financial joint committee of four to do the work of the Antarctic Expedition in this country. We have been so engaged now for five and a half years. I think there are at least two of my colleagues present, and I appeal to them whether we have ever had a serious misunderstanding, whether we have ever really quarrelled, whether our good fellowship and our harmony, to compare small things with great, was not like the good fellowship and the harmony which prevailed in the ward-room of the *Discovery* in winter quarters. I am quite sure, when the time comes finally to wind up our accounts, we shall part quite as good friends as we were at the first meeting we had five years ago. I can never sufficiently express my gratitude to the staff of the Society, for without a good staff and a zealous staff the President could never get his work done at all. But our staff is an exceptionally good one, and the Fellows of the Society will remember that the different heads of departments require different qualifications. They have all worked with great efficiency, have helped me in a way that I can never express sufficient thanks for, and have done credit to this Society. Finally, I wish to speak of the whole body of the Fellows; they have shown the greatest kindness to me during the whole time I have been President. I have had a very, very large correspondence with numbers of them, and I have never received an unkind word; I have never even received a complaint from any of them during the whole time. I cannot—words will not allow me—express the thanks I feel at the kindness I have received from the great body of the Fellows. I thank you all from my heart for the way this toast has been received by you.

The Right Hon. W. Ellison Macartney, in presenting a silver cup to Sir Clements Markham and a gold pen to Lady Markham on behalf of the relatives of the officers and staff of the *Discovery*, spoke as follows:—

Right Hon. W. Ellison Macartney: Sir George Goldie, my lords, M. Cordier, and gentlemen, I have to express my warmest thanks to the Council of the Royal Geographical Society for affording me an opportunity on this memorable occasion of presenting, on behalf of the immediate relatives of the officers and scientific staff who served on the Antarctic ship *Discovery*, a souvenir to Sir Clements Markham of those long and eventful months when that ship lay in Antarctic waters. We know well that from the moment the organization of this expedition began, until that ship was moored in a home port, we have great reason to be deeply grateful to the Council of this Society, to the joint committee of this Society and of the Royal Society, and to the Government, for the invaluable assistance which they rendered in safeguarding those who were engaged in Antarctic exploration. But, gentlemen, there is always one man in these affairs on whose shoulders lies the weight of supreme responsibility, to whom the relatives of those who are absent will always go for sympathy and for counsel, or for the inspiration of hope and confidence, and it was on Sir Clements Markham that this heavy burden lay in this instance. Gentlemen, I need not say

that he never failed; he made us all feel confident that everything that long and accumulated experience, that prudent foresight could imagine, had been done to secure the safety of those who were engaged in that expedition, and his resolute and indomitable confidence banished those phantoms which otherwise would have darkened the long and weary months of expectation and of silence. Sir Clements Markham, I ask you to accept this cup. It bears this inscription—

> "Presented to Sir Clements Markham, K.C.B., F.R.S., President of the Royal Geographical Society, by the relatives of the Officers and Scientific Staff of the Antarctic ship *Discovery*, in recognition of his unwearying care for the welfare and safety of the Officers and Crew of that ship."

We trust, Sir Clements Markham, that this cup will remind you in years to come, which we all hope will be long, prosperous, and full, of the abiding and affectionate gratitude which we all feel to you for the unwearying and unceasing care which you took, during those months, to provide for the safety and welfare of this ship. I have one more duty to perform. I ask you to convey this small case to Lady Markham. Lady Markham has the pen of a ready writer, and there was no home connected with the men who were on board the ship into which her letters did not penetrate, and it is our wish that this slight memento will, in time to come, remind her of the hope and the confidence which her letters brought with them.

Sir Clements Markham: When I induced the gallant Antarctic explorers to undertake a dangerous and perilous service, I fully expected, and it would have been perhaps right, that all their relations would have hated and detested me; instead of that, I found nothing from them but kindness and confidence. Many and many are the times in which we have talked and discussed over what should be done, and I cannot help saying how very helpful they were to me, especially in the dispatch of the *Morning*. How hard they worked! How much work they took off my hands! I will not specially mention any one of them, but I was acquainted with them all, and saw them constantly; they were all anxious to help, and in their great anxiety it was my business to comfort them with assurances that the ship was safe, and that she would return. I felt quite certain of that myself, as I told you all last year. And she did come out safely. Most of those relations relied upon me and believed me, and I really think that a great deal of their anxiety was removed by their confidence in me. I did not expect such kindness as is represented by this beautiful present. I shall always look upon this cup, presented to me by the relations of the officers and scientific staff, coupled with the silver sledge which was so kindly presented to me by the officers and men of the *Discovery*, as the two possessions which I shall value most. It will remind me of many happy days, of many conferences which caused anxiety then, but which may now be looked back upon only with pleasure, and they will also serve to remind me of the kindness of the relations and of the gallant conduct of the officers and men. I now convey to Mr. Macartney Lady Markham's expression of thanks, and I am sure she will feel the kindness of her friends as deeply as I have done.

Major L. Darwin, in proposing the toast of "The Other Guests," said: Sir George Goldie, my lords, and gentlemen, I rise not only to express our pleasure at welcoming a large number of guests here to-night, but also our gratitude to them for attending here on this occasion. This is a banquet given in honour of Sir Clements Markham, whose health we have drunk in a manner so cordial that it must have convinced him—if he needed any convincing—that our expressions of gratitude and good-will to him are very, very real. It was certain that his health would have been drunk with enthusiasm—there was no question about that; but

I think many of us would have felt that this banquet had not been made adequate to the occasion, if we had not succeeded in attracting to our board a large number of distinguished guests. I should like to mention each one of the guests by name, and to thank them for associating themselves with us in endeavouring to do honour to Sir Clements Markham on this occasion, but the number of these guests is too great. Naturally, in the first place, I should wish to welcome those who have come from afar. You will desire me, I am sure, to express on your behalf the most cordial reception possible to M. Cordier, the President of the French Geographical Society, Geography has to recognize the fact of the existence of political boundaries; but I think we English geographers would like to see all boundaries entirely removed from our maps in so far as those boundaries represent lines of demarcation between nations in any way unfriendly to each other. I do not know what M. Cordier's sensations were on crossing the Channel, but I sincerely trust that whatever they were he did not feel, and I am certain he ought not to feel, that he was crossing any such boundary as that which I have alluded to. We will ask M. Cordier to take back to France a message to the effect that we regard his presence here to-night a specially cordial and graceful act. We will ask him to tell our *confrères* in Paris that this act of kindness on his part, as representing them, will be an act we shall not readily forget. I think on this occasion I may also allude to the President of another Geographical Society, although he is not with us to-night—Baron von Richthofen, the eminent President of the Berlin Geographical Society, who writes as follows:—

"The President of the Geographical Society of Berlin, Baron Ferdinand von Richthofen, begs to offer his thanks for the kind invitation of the Vice-Presidents and Council of the Royal Geographical Society to the banquet which is to take place in honour of the retiring President, Sir Clements Markham, on the anniversary of the Society, Monday, May 22. He had entertained the hope to be able to accept it, but, to his most sincere regret, is now prevented by official duties from taking part at the honorary banquet and attending the anniversary of the Society at this particular occasion, when vivid expression will be given to the general admiration and high appreciation of the extraordinary merits which his noble friend has earned, not only as the leader of the pre-eminent Society which has enjoyed the favour of his Presidency for many years, but also for the progress of geographical exploration in general. He desires to make use of this opportunity to offer cordial congratulations, in his own name and in that of the Berlin Geographical Society, to Sir Clements Markham for having crowned the geographical work of his life by personally planning and organizing the glorious British Antarctic Expedition, and choosing in the person of Captain Scott, a commander of the standard of his great predecessors Cook and Ross, and for his having had the good fortune to welcome this expedition on its safe return and to present its memorable achievements in the exploration of the Antarctic continent to his countrymen and to the world at large. In congratulating the Royal Geographical Society for having flourished twelve years under such eminent guidance, he participates in its feeling of regret at the loss it now sustains by the resolution of its high-minded President to resign his office."

I think these words from such an eminent geographer speak volumes, and, I am sure, in your name we may send back a message to him thanking him for his cordial and kindly expressions. There is one other President of a geographical society I must simply mention by name also. He too has crossed a political boundary to come to us. It is a political boundary which he and his compatriots would not see wiped off the map for all the world. I allude to Prof. Geikie, the President of the Scottish Society. These, gentlemen, are peaceful invasions which

give us nothing but pleasure; but it must not be supposed that all peaceful invasions give pleasure to the proprietors of the territories invaded. There are certain scientific men who have accused us geographers of the habit of always invading the scientific territories surrounding us, of invading them with a deliberate intention of filching some subject from those territories, and bringing it home and claiming it as exclusively ours. Well, gentlemen, I am not to-night going either to admit or deny this charge, but what I do feel is that these marauding expeditions, if they have taken place, cannot have given rise to any feelings of ill-will, because we have to-night amongst us most distinguished representatives of various societies. We have the honour to have amongst us Sir Thistleton Dyer, Mr. Maw, the President of the Royal Astronomical Society, and Dr. Shaw, our weather prophet, three distinguished gentlemen who represent such divers sciences as botany, astronomy, and meteorology. I presume that the Royal Society, which claims as its sphere the whole universe of science, will not consider that any invasion of its territory can ever take place. I should, therefore, like to associate with the name of Mr. Kempe another peaceful invasion, the extremely successful invasion of the Antarctic Regions which has taken place under the joint auspices of the Royal Society and the Royal Geographical Society. The Royal Society is the mother of all the scientific societies in England, and I presume, therefore, that we Fellows of the Royal Geographical Society may look on the Royal Society as our grandmother. We wish to welcome Mr. Kempe, the Treasurer of that Society, most heartily here to-night. If I have boasted of successful invasions, it must not be supposed that we are always successful in our invasions. We have for many years been endeavouring to force an invasion of geographical teaching within the walls of the various schools and colleges of this country, and we have not been entirely successful in that effort at present. I hope we shall succeed. We shall if we persevere, and I trust that the presence of Sir W. Anson, who is, in fact, our Educational Minister, proves that he is friendly to our endeavours in this respect. At all events, we have amongst us Dr. Gow, the Headmaster of Westminster School, a keen advocate of the teaching of geography in schools. I do not know whether we are right in speaking of the invasion of geography to the field of literature or not, but certain it is that geography is taking a more prominent part in literary work. If I may mention the work of a late Fellow of ours, 'With Edged Tools,' by "Seton Merriman," or to call him by his proper name, Mr. Stowell Scott; or 'The Four Feathers,' by Mr. Mason; you will find that those novels, not only teach their readers a great deal of geography, but they prove that the authors have studied geography in distant countries with the greatest possible care. We are honoured to-night with the presence of Mr. Anthony Hope Hawkins, who has described in the most vivid colours the heroes and half-heroes of our most distant colonies, and we wish to thank him most sincerely for his presence amongst us, because we were exceedingly glad that literature should also be so honourably and so well represented. Many other names I should like to mention. We have amongst us, for instance, the Agents-General for Victoria, New South Wales, Queensland, and New Zealand, and I never can mention these colonies without again and again thanking them for their generous contributions to the Antarctic Expedition. But the thought is forced upon me at the present moment that when I am dining as a guest at a banquet of this sort, nothing pleases me more than that my name should not be mentioned. It requires a very cordial compliment to make up for the anxiety—might I say, the indigestion?—that comes from a sudden call to make an after-dinner speech. I do not know what will be felt by the three gentlemen I have to mention, but if their sensations at all approach my own on a similar occasion, I do trust that they will,

at any rate, believe that we mean to pay them the most sincere compliment, and to thank them most heartily for their presence here to-night. Gentlemen, I give you "The Other Guests" of the evening, coupled with the names of M. Cordier, President of the Paris Geographical Society, Mr. A. B. Kempe, and Mr. Anthony Hope Hawkins, with the full certainty that you will drink their health in the most cordial manner.

Prof. H. CORDIER: Mr. President, my lords, and gentlemen, I hope I shall be excused if I say but a few words to-night, as I caught a cold two days ago, but I am glad to be able to tell Major Darwin that I had nothing to fear crossing the Channel. The Paris Geographical Society felt they could not hear of a banquet in honour of your retiring illustrious President without being represented by one, at least, of its members. I am proud to be this member, and I bring the tribute of the oldest Geographical Society in the world to Sir Clements Markham. During his presidency the Paris Geographical Society and the Royal Geographical Society have become closer friends. If I may be allowed to say a few words in my own name, they are, that I have known Sir Clements Markham personally for the last ten years, and I have known him by his valuable works for all time. In expressing my regret at his resignation from the administrative work of the Royal Geographical Society, I cherish the hope, and I think not vainly, that there will be some benefit to science, and that your retiring President will have more leisure, and will spend that leisure in scientific research.

Mr. A. B. KEMPE: Mr. President, my lords, and gentlemen, I am sure you will concur with me in regretting that the President of the Royal Society has been unable to accept the invitation of the Council of this Society to be present here to-night. He most fully shares in that regret, and has commissioned me to state it is only owing to the impossibility of his being in two places at once that he is not here. He had previously accepted an invitation to be present at the centenary dinner of the Royal Medical and Chirurgical Society, and therefore is unable to be here to do honour to the guest of the evening. I have been asked to speak in his absence as one of those representing the guests, and I certainly have no reason to complain that I have been so asked, for it gives me an opportunity of adding my testimony to that of previous speakers as to the indomitable energy and whole-hearted zeal with which Sir Clements Markham has identified himself with the interests of your great Society. I have not the honour, gentlemen, to be a Fellow of this Society, but for the past five and a half years I have, in conjunction with your Treasurer and Mr. Chalmers, been closely associated with Sir Clements Markham in the financial work of the National Antarctic Expedition. Sir Clements Markham suggested that during all that period we had no serious differences on the Antarctic Finance Committee. Well, we have had Antarctic breezes there, and I am not sufficiently expert in nautical matters to be able to say how many knot breezes they were, but I think they partook very largely of the character of "cats-paws." We very soon got into smooth waters again, and I think those breezes are now forgotten. My services, gentlemen, on that committee have given me opportunities of judging of the way in which Sir Clements Markham does his work, and I have been deeply impressed with the extraordinary zeal and extraordinary skill and extraordinary care about the most minute details, that characterized his work on the Antarctic Expedition. The Antarctic Expedition has been, I believe, the dream of his life, and he certainly has devoted his time and energy, unceasingly, to ensure its success. It is perfectly true, as has been said by Sir George Goldie, that if it were not for Sir Clements Markham that expedition would never have started, and we are indebted to him unquestionably for the large measure of success that has been accorded to it. I have not had the

honour, gentlemen, of being associated with Sir Clements Markham in other enterprises, but I should greatly misjudge him if I fancied for one moment that he had not brought the same zeal and the same whole-hearted devotion to the other work which he has done during his tenure of office as President of this Society. We are all glad to learn that he has decided to have a rest, but we very much doubt if he will take it. Now, gentlemen, I have taken this opportunity to say a few words with regard to Sir Clements Markham, but I must not forget that the duty imposed on me to-night is that of acting as one of the mouthpieces of your guests, and I am sure I am speaking the mind of them all in saying how greatly we appreciate the honour you have done us in asking us to participate in your recognition of Sir Clements Markham's work, and how much we thank you for the entertainment you have given us to-night. You, Mr. President, have been so recently appointed, that I think it hardly decent for me to say how greatly we should enjoy being invited to another banquet of the same sort; but I think we may very properly express our assurance that you will during your term of office certainly do all you can to maintain, and will successfully maintain, the progress of the Society which owes so much to your predecessor whom we are specially met to-night to honour. Gentlemen, I thank you on my own behalf and that of the other guests for the cordial manner in which you have drunk this toast.

Mr. ANTHONY HOPE HAWKINS: Mr. President, my lords, and gentlemen, I venture to think that you, sir, passed rather lightly over that episode of Sir Clements Markham's career in what you referred to as the quasi-historical romance. I can only say that if Sir Clements Markham had been desiring a foretaste of Arctic Regions, he could not do better than begin by writing a first novel. As I look deeper into the reasons why I have the honour of being here to-night, I confess that to me they are inscrutable, unless I trace them back to the ancient relation there is between exploration and fiction. Many of the greatest novelists have purported to be explorers; many of the greatest explorers have been accused of being novelists. So we have our friendship, gentlemen. We have our enmities too. Every now and then you take away from us the regions which have been our own. The top of the highest mountains Sir Martin Conway does not hesitate to say he has climbed; Sir Frank Younghusband actually goes to Lhasa, a place which we thought was our own through all eternity. I have not myself, like my friend Mr. Mason, who has been to Morocco, and my friend Mr. Wells, who has been to the Moon, been a great traveller. There may be one or two countries which we have invented which you will never find. But I do not think that the voice of literature, even in the person of a very humble exponent of its most humble and merely recreative form, should be absent to-night, because, to my thinking, there is no more charming form of literature than a good book of travel or exploration. Your Society, gentlemen, and the work that you inspire, are the truest pioneers, not only of what we call civilization, but what we know to be knowledge. You not only open new empires of the physical globe, but you open new spheres of intellectual and speculative thought. With every new land that is traversed by one of your expeditions, with every new sea that is crossed by one of your ships, there comes, too, new knowledge of the nature and history and thought of other lands, transforming inevitably and enormously, as the years go by, our conception of the life and the state of man. And of that great work—and I do not know, without speaking the language of compliment, that there is a greater—the man whom we are here to-night to honour has been the leading spirit and the inspirer. I confess I should count it a great honour and a great privilege to come here to-night as a silent guest, but it is a greater to be privileged to say these few words in honour of a science which seems to me to combine all the good there is in all sciences, and

of a man who is most deservedly honoured to-night, and who, I think, must carry away with him what is to any man the sweetest of all praises—the applause of his fellow-craftsmen.

Sir Thomas Holdich proposed the toast of the Medallists and the recipients of the Society's other awards, which was responded to by Sir Martin Conway.

Mr. Edward L. S. Cocks proposed the toast of "The President," to which Sir George Goldie briefly responded, and the proceedings terminated by the company singing "Auld Lang Syne."

Fifteenth Meeting, June 5, 1905.—The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

ELECTIONS:—*Clifford Harold Brookes, M.D.; Henry Algernon Cholmley Darley; Captain Gilbert Robertson Frith, R.E.; Captain Eric Francis Hausburg (R. Lancashire Regt.); Dean C. Worcester.*

THE NEW PRESIDENT.

The PRESIDENT, the Right Hon. Sir GEORGE TAUBMAN GOLDIE, said: Our special business to-night is to hear and discuss Colonel Massy's paper, and, in the ordinary course, I should at once introduce him to the meeting, and call upon him to begin. But the kind way that you have received me reminds me, if indeed I need reminding, that, although during the nine years I was Vice-President I have occasionally taken this chair vicariously, this is the first time I have occupied it as President of the Society; and perhaps you may expect me to say just a few words in honour of that occasion. Need I tell you that I am very proud to have had entrusted to me this leading part in the administration of a great Society, which has not only rendered incalculable services to geography, but in doing so has indirectly promoted the interests of many other sciences. Nor can I forget the great services that the Royal Geographical Society has done, indirectly also, on behalf of the empire; nor again can I forget the long list of illustrious men, able and distinguished, who have preceded me in this chair, and I feel it a special honour to have been called upon to succeed to that great geographer, our twelve years' President, Sir Clements Markham. You will not, of course, expect that I can even approach him in performing my duties as President; that is out of the question. He has given to this subject, geography, and to the interests of the Society a whole lifetime, and he has, of course, performed his duties in a way that I think no other living man could perform them. But although I cannot rival him, you have a right to expect from me that I should perform my duties to the utmost of my powers, and I can, at any rate, promise you that your expectation shall not be disappointed. I think that is all I have to say on the personal question.

The paper read was:—

"Exploring Journeys in Asia Minor." By Colonel P. H. H. Massy.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *Z. Deutsch. u. Österreich. Alpenv.* **35** (1904): 1–17. **Blaas.**
Struktur und Relief in den Alpen. Von J. Blaas. *With Profiles.*

Alps. *Z. Deutsch. u. Österreich. Alpenv.* **35** (1904): 77–87. **Reishauer.**
Italienische Siedlungsweise im Gebiete der Ostalpen. Von H. Reishauer.

Alps—Cartography. *Z. Deutsch. u. Österreich. Alpenv.* **35** (1904): 18–29. **Oberhummer.**
Die Entwicklung der Alpenkarten im 19. Jahrhundert. Von E. Oberhummer. III. Teil. Die Schweiz. *With Maps.*

Austria. *Meteorolog. Z.* **22** (1905): 113–119. **Topolansky.**
Einige Resultate der 20-jährigen Registrierungen des Regenfalles in Wien. Von Dr. M. Topolansky.

Austria—Dalmatia. *Deutsch. Rundschau G.* **27** (1905): 211–216. **Gelcich.**
Volkswirtschaftliches aus Dalmatien. Von E. Gelcich. *With Illustration.*

Austria—Dalmatia. *Meteorolog. Z.* **22** (1905): 77–80. **Kerner.**
Messung der täglichen Temperaturbewegung in einem Küstenflusse des Karstes in Dalmatien. Von Dr. F. v. Kerner.

Austria—Istria and Dalmatia. *M.R.R.G. Ges. Wien* **48** (1905): 3–30. **Waagen.**
Fahrten und Wanderungen in der nördlichen Adria. Von Dr. L. Waagen.

Austria—Tyrol. *Quarterly J. Geolog. S.* **61** (1905): 97–141. **Skeats.**
On the Chemical and Mineralogical Evidence as to the origin of the Dolomites of Southern Tyrol. By Prof. E. W. Skeats, D.Sc. *Map and Plates.*

Austria—Vienna. *Deutsch. Rundschau G.* **27** (1905): 269–271. **Umlauft.**
Die jüngste Stadterweiterung Wiens. Von Prof. Dr. F. Umlauft. *With Plan.*

Balkan Peninsula. *Le Globe, Mém. S.G. Genève* **43** (1904): 1–93. **Pittard.**
Ethnologie de la Péninsule des Balkans. Par le Dr. E. Pittard. *With Plates.*

Belgium. *B.S. Belge Géologie (Procès-Verbaux)* **18** (1904): 239–240. **Deladrier.**
Un projet de détournement de la Lesse dans la région de Han. Par E. Deladrier.

Bulgaria. *Deutsch. Rundschau G.* **27** (1904): 58–68. **Meinhard.**
Durch das Rilagebirge. Von F. Meinhard, junr. *Illustrations.*

France. *Ann. G.* **14** (1905): 23–35. **Barré.**
Origines tectoniques du golfe de Saint-Malo. Par le Commandant O. Barré. *With Maps.*

France. *C. Rd.* **140** (1905): 466–467. **Bergeron.**
Sur la tectonique de la région située au nord de la Montagne Noire. Note de J. Bergeron.

France—Alps. *Ann. Club Alpin Français* **30** (1903): 439–510. **Helbronner.**
Triangulation géodésique des massifs d'Allevard, des Sept-Laux et de la Belle-Étoile. Par P. Helbronner. *Maps and Illustrations.*
Records the work done in 1903 on behalf of the "Commission de Topographie du Club Alpin," with a view to supplementing the Government survey map.

France—Brittany. *Ann. G.* **14** (1905): 36–51. **Vallaux.**
L'évolution de la vie rurale en Basse Bretagne. Par C. Vallaux.
Noticed in the Monthly Record (*ante*, p. 81).

France—Dauphiné. *Ann. Club Alpin Français* **30** (1903): 416–438. **Ferrand.**
Les premières cartes du Dauphiné. Par H. Ferrand. *With Maps.*

France—Gironde. *Ann. Club Alpin Français* **30** (1903): 388–415. **Durègne.**
La grande montagne de la Teste de Buch. Par E. Durègne. *With Maps and Illustrations.*
"Montagne" is used here in a somewhat special sense, being applied to an area of wooded dunes in the Landes.

France—Glaciers. *Ann. Club Alpin Français* **30** (1903): 537–547. **Favre.**
Commission Française des Glaciers. Observations sur les glaciers du massif de la Vanoise pendant l'été 1903. Par le guide J. A. Favre, de Pralognan. *With Illustrations.*

France—Glaciers. *Ann. Club Alpin Français* **30** (1903): 511–536. **Girardin.**
Commission Française des Glaciers. Observations glaciaires en Maurienne, Vanoise et Tarentaise (21 août—24 Septembre 1903). Par P. Girardin. *With Map and Illustrations.*

France—Pyrenees. *C. Rd.* **140** (1905): 542–545. **Bertrand.**
Sur le rôle des charriages dans les Pyrénées de la Haute-Garonne et de l'Ariège. Note de L. Bertrand.

Germany. *G.Z.* **11** (1905): 114–118. **Fischer.**
Zum ersten Jahrgang des Jahrbuches für die Gewässerkunde Norddeutschlands. Von Dr. K. Fischer.
Intended as a kind of introduction to the year-book, in the preparation of which the writer took part.

Germany—Bavaria. *Globus* **87** (1905): 181–186. **Jaeger.**
Die Chiemseelandschaft. Von J. Jaeger.

Germany—Vistula. *Petermanns M.* **51** (1905): 41–42. **Geinitz.**
Die geologische Geschichte des Weichseldeltas. Von Prof. Dr. E. Geinitz. *With Map.*

Greece. *English Hist. Rev.* **20** (1905): 307–309. **Miller.**
The Name of Navarino. By W. Miller.

Holland—Maas. *B.S.G. Com. Paris* **27** (1905): 44–48. **Zobrist.**
Correction de la Meuse dans les Pays-Bas. Par T. Zobrist.

Iceland and Faroe Islands. *Ymer* **24** (1904): 392–399. **Thoroddsen.**
Hypotesen om en post-glacial Landbro over Island og Færöerne set fra et geologisk Synspunkt. Af T. Thoroddsen.
On a supposed post-glacial land connection between Iceland, the Færoes, etc.

Italy. *B.S.G. Italiana* **5** (1904): 909–930. **Lorenzi.**
Escursioni di geografia fisica nel bacino del Liri. Del Prof. A. Lorenzi. *With Illustrations.*

Italy—Venetia. *Riv. G. Italiana* **12** (1905): 39–43. **Bertolini.**
Di una caratteristica impronta toponomastica e storica della conoide-brughiera della Cellina. G. L. Bertolini. *With Maps.*
On the frequent occurrence of the designation "Tezza" (= cattle-station) in the district in question, and on the absence of "castelli" and walled towns along a line defined by physical characters.

Norway. *Norske G.S. Aarb.* **15** (1903–1904): 14–34. **Reusch.**
Fra Kaafjorden i Lyngen. Af Dr. H. Reusch. *With Sketch-map and Illustrations.*

Norway—Valleys. *Norske G.S. Aarb.* **15** (1903–1904): 1–13. **Reusch.**
Nogle dale med flad bund af fast fjeld. Af Dr. H. Reusch. *With Sketch-map and Illustrations.*

Pyrenees. *Questions Dipl.* **18** (1904): 761–772. **Bégouën.**
A propos des chemins de fer transpyrénéens. Par Comte H. Bégouën.

Russia. *Globus* **87** (1905): 21–27, 37–44. **Adler.**
Die deutsche Kolonie Riebensdorf im Gouvernement Woronesh. Von Dr. B. Adler. *With Plan and Illustrations.*

Spain. *Spelunca* **5** (No. 37) (1904): 69–84. **Dufau.**
Grottes et abîmes du pays Basque. Par C. Dufau.

Spain. **Macleay.**
Mining and Metallurgical Industries of Spain in 1903. Foreign Office, Miscellaneous, No. 623, 1904. Size 9½ × 6½, pp. 34. *Price* 2½*d.*

United Kingdom—Canals. *J.S. Arts* **53** (1904): 40–53. **Lee.**
The British Canals Problem. By A. Lee, J.P.

United Kingdom—Ireland. **Coffey and Praeger.**
P.R. Irish A. **25**, Sec. C (1904): 143–200.
The Antrim Raised Beach: A Contribution to the Neolithic History of the North of Ireland. By G. Coffey and R. L. Praeger. *Map and Illustrations.*
Noticed in the Monthly Record for May (p. 561).

United Kingdom—Scotland. *Scottish G. Mag.* **20** (1904): 628–640. **Murray and Pullar.**
Bathymetrical Survey of the Fresh-water Lochs of Scotland. Part vi. The Lochs of the Ewe Basin. Under the Direction of Sir John Murray, K.C.B., etc., and L. Pullar. *With Index-map and Illustrations.*

United Kingdom—Scotland. **Smith.**
Scottish G. Mag. **20** (1904): 617–628; **21** (1905): 4–23, 57–83.
Botanical Survey of Scotland. iii. and iv. Forfar and Fife. By W. G. Smith, B.SC., etc. *With Maps and Illustrations.*

ASIA.

Asia. *Deutsch. Rundschau G.* **27** (1905): 225–226. **Webersik.**
Der Brief- und Postkartenverkekr Asiens im Jahre 1902. Von G. Webersik. *Map.*
Japan stands easily at the head of the list with 15·3 letters or postcards per head of population, Kiau-chou next with 10·6, and the Straits Settlements third with 9. The high figure for the second is of course easily accounted for, and for the third also, if the purely native territories are not included; but as round numbers only are given in this case, the result is, perhaps, not entirely to be trusted.

China. *A travers le Monde* **11** (1905): 69–70. **Foy.**
La Mission de M. Maximilien Foy en Extrême-Orient. Projets de Voies ferrées en Chine. *Map.*
The writer advocates, in addition to lines from north to south and east to west with their centre at Hankow, such as are already partially in exploitation, a trunk line from Peking to Cheng-tu, and so to Yunnan and Tongking.

Chinese Empire—Tibet. *National G. Mag.* **16** (1905): 27–38. ———
Views of Lhasa. *Illustrations.*
Reproductions of photographs taken by Tsibikoff and Narzunoff.

Eastern Asia. *Ann. Hydrographie* **33** (1905): 61–66. **Herrmann.**
Die russischen hydrographischen Arbeiten im Stillen Ozean. Nach dem Bericht des Oberst M. Schdanko von J. Herrmann.

Eastern Asia. *G.Z.* **11** (1905): 51–55. **Regel.**
Das ostasiatische Küstenland zu Beginn des Jahres 1904. Von Dr. A. Regel.

India. **Longe.**
Extracts from Narrative Reports of the Survey of India for the season 1902–1903. Prepared under the direction of Lieut.-Colonel F. B. Longe. Calcutta, 1905. Size 13½ × 8½, pp. 84. *Index Map. Price* 2*s.* 3*d.*
Includes notes on the survey of the Sambhar salt-lake in Rajputana.

India. **Nevill.**

[District Gazetteers of the United Provinces of Agra and Oudh. Compiled and Edited by H. R. Nevill.] Vol. **3**, Muzaffarnagar (pp. 332, xxxviii., xiv., and vi.); vol. **4**, Meerut (pp. 316, xlviii., and viii.); vol. **5**, Bulandshahr (pp. 314, xxxviii., and vi.); vol. **37**, Lucknow (pp. **2**, 268, xxxiv., and vi.); vol. **38**, Unao (pp. 252, xl., and vi.); vol. **45**, Bahraich (pp. 222, xliv., and vi.); vol. **46**, Sultanpur (pp. 212, xliii., and vi.). Allahabad, 1903–4. Size 9 × 5½. *Maps. Presented by the India Office.*

India—Botany. *Records Botan. Surv. India* **3** (1905): 143–340. **Prain.**

The Vegetation of the Districts of Hughli-Howrah and the 24-Pergunnahs. By D. Prain. *With Map.*

India—Himalaya. *Scottish G. Mag.* **21** (1905): 173–182. **Freshfield.**

The Sikhim Himalaya. By D. W. Freshfield. *With Illustration.*

India—Himalayas. *Z. Deutsch. Österreich. Alpenv.* **35** (1904): 88–104. **Pfannl.**

Eine Belagerung des Tschogo-Ri (K_2) in der Mustaghkette des Hindukusch (8720 *m.*). Von Dr. H. Pfannl. *With Illustrations.*

India—Railways. ———

Administration Report on the Railways in India for the Calendar Year 1903. London: Eyre & Spottiswoode, 1904. Size 13½ × 8½, pp. iv. and 330. *Map and Diagram. Price* 3*s.* 8*d.*

India—Sikkim. *J.S. Arts* **53** (1905): 264–273. **Freshfield.**

The Gates of Tibet. By D. W. Freshfield. *With Map.*

Indian Ocean—Maldive and Laccadive Islands. **Gardiner.**

The Fauna and Geography of the Maldive and Laccadive Archipelagoes. Edited by J. S. Gardiner. Vol. **2**, Part iv., and Supplement 1. Cambridge: University Press, 1905. Size 11½ × 9, pp. 807–921, 923–1040. *Plates. Price* 15*s. net each part.*

Japan. ———

Japan and the Japan Mission of the Church Missionary Society. Fourth Edition. London: Church Missionary Society, 1905. Size 7½ × 5½, pp. viii. and 182. *Map and Illustrations. Price* 2*s. net. Presented by the Church Missionary Society.*

AFRICA.

Abyssinia. *La G., B.S.G. Paris* **11** (1905): 66–70. **Le Roux.**

Reconnaissance du lac Zouaï, de ses îles et de ses archives. Par M. Hugues Le Roux.

See note in Monthly Record for June (p. 676).

Africa. *G.Z.* **11** (1905): 1–18. **Dove.**

Grundzüge einer Wirtschaftsgeographie Afrikas. Von Prof. Dr. K. Dove.

Africa. *C. Rd.* **140** (1905): 349–350. **Lapparent.**

Sur l'extension des mers crétacées en Afrique. Note de A. de Lapparent.

British Central Africa. ———

British Central Africa Protectorate. Diary, 1905. With Official Handbook on the Protectorate compiled in the Secretariat, B.C.A.A., Zomba. Size 10½ × 8½, pp. 64.

British East Africa—Railway. ———

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Index to the Annual Reports of the Geological Commission for the years 1896–1903. Compiled by E. H. L. Schwarz. Cape Town, 1904. Size 10 × 7½, pp. 52. *Presented by the Geological Commission, Cape of Good Hope.*

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Die Salzversorgung Zentralafrikas. Von Dr. C. Müller.

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Thysville. *With Illustrations.*
This name has been given to Sona-gongo, on the railway to Stanley pool.

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Vocabularies of the Kamba and Kikuyu Languages of East Africa. By H. Hinde. Cambridge: University Press, 1904. Size 7½ × 5, pp. xviii. and 76. *Price 3s. net. Presented by the Publishers.*

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Die Saline Gottorp der Central-Afrikanischen Seeen-Gesellschaft m. b. H. Von O. Schloifer. *With Illustrations.*
These salt works are in Uvinza, east of Ujiji.

German East Africa. *M. Deutsch. Schutzgeb.* **16** (1903): 253–263. **Stolowsky.**
Erkundung der Wegeverhältnisse zwischen der Station Mahenge und Kungulio am Ulanga. Von Dr. Stolowsky. *With Map.*

German South-West Africa. **Hesse.**
Z. Kolonialpolitik **6** (1904): 899–950; **7** (1905): 1–48, 89–154.
Die Schutzverträge in Südwestafrika. Von Dr. H. Hesse.
On the agreements with native chiefs recognizing German authority.

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Northern Territories of the Gold Coast. Report for 1903. Colonial Reports, Annual No. 429, 1904. Size 10 × 6½, pp. 22. *Price* 1½*d.*

Madagascar. *B.S.G. Lille* **42** (1904): 365–395. ——
Madagascar. L'Inauguration du Chemin de fer de Tananarive à la Mer. *With Map and Illustrations.*

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Le Chemin de fer de Madagascar. *With Map.*

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Quelques mots sur les confréries religieuses marocaines.

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Le Cours moyen de l'Oued Dra. Par Capitaine Regnault. *With Map.*
Noticed in the Monthly Record for June (p. 565).

Morocco—Meteorology. *Meteorolog. Z.* **21** (1904): 334–335. **Hann.**
Resultate der meteorologischen Beobachtungen zu Marakesch (Marokko) 1900 und 1901. Von J. Hann.

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Niger Delta Natives, with special reference to maintaining and increasing the population of Southern Nigeria. By G. F. Darker. *With Maps and Illustrations.*

Rhodesia—Ruins. *Norske G.S. Aarbog.* **15** (1903–1904): 142–174. **Skattum.**
Ophir, Bibelens guldland og Syd-Afrikas ruiner. Af O. J. Skattum. *With Map and Illustrations.*

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Sur les roches cristallines rapportées par la Mission Saharienne. Note de F. Foureau et L. Gentil.

Senegal. *B.S.G. Lille* **43** (1905): 58–62. **Mazeran.**
Navigabilité du fleuve Sénégal. Compte-rendu du Rapport de M. le Lieut. Mazeran.
See note in the *Journal* for January (p. 93).

Somaliland. *J.R. United Service I.* **49** (1905): 169–182. **Owen.**
The Somaliland. Operations, June, 1903, to May, 1904. By Major F. C. Owen. *With Maps.*

South Africa—Rainfall. *T.S. African Philosoph. S.* **15** (1904): 1–28. **Sutton.**
An Introduction to the Study of South African Rainfall. By J. R. Sutton. *With Index-Map and Tables.*

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Die Handelszonen des Sambesi. Von W. Schütze. *Illustrations.*

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Der "Caprivizipfel" und seine Nachbargebiete in den internationalen Verträgen. Von Dr. R. Hermann.

On the international agreements affecting the delimitation of the north-east corner of German South-West Africa.

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Die neue Westgrenze von Togo. *Map.*

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Transvaal Mines Department. Annual Report of the Government Mining Engineer for the year ending June 30, 1904. Part ii. Size 13½ × 8½. *Map, Plans and Diagrams.*

Tripoli. *Monthly Rev.* **18** (1905): 90–106. **Hogarth.**
Cyrenaica. By D. G. Hogarth. *With Plates.*

Tripoli. *La G., B.S.G. Paris* **10** (1904): 363–370. **Mathuisieulx.**
Troisième Mission en Tripolitaine (1901). Par H. M. de Mathuisieulx. *With Map.*

NORTH AMERICA.

Alaska. *B. American G.S.* **37** (1905): 26–40. **Brooks.**
The Investigation of Alaska's Mineral Wealth. By A. H. Brooks. *With Map.*

Canada. *J. Geology* **12** (1904): 722–743. **Ogilvie.**
The effect of Superglacial Débris on the advance and retreat of some Canadian Glaciers. By I. H. Ogilvie. *With Map and Illustrations.*

Canada—Bay of Fundy. *National G. Mag.* **16** (1905): 71–76. ——
Tides in the Bay of Fundy. *With Illustrations.*

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Notes on the Natural History and Physiography of New Brunswick, Nos. 81–88. By W. F. Ganong. *With Maps and Illustration.*

Canada—New Brunswick. **Ganong.**
A Monograph of the Origins of the Settlements of New Brunswick. By W. F. Ganong. (From the Transactions of the Royal Society of Canada. Second Series, 1904–1905. Vol. x., section ii.) Ottawa: J. Hope & Sons, 1904. Size 9½ × 6½. pp. 186. *Maps and Diagram.*

North America—Meteorology. *Monthly Weather Rev.* **32** (1904): 461. **Odenbach.**
An Index of Meteorological items in the Jesuit Relations. By Rev. F. L. Odenbach, S.J.

North and Central America. **Ridgeway.**
B. United States Nat. Museum, No. 50 (1904): pp. xx. and 802.
The Birds of North and Middle America. By R. Ridgeway. Part iii. *With Illustrations.*

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Proportion of the Sexes in the United States. *With Maps.*

The proportion of the sexes about 1900 in the United States as a whole was 51·1 male to 48·9 female. While in the country the male excess had become accentuated since 1890, in the towns it had given place to an excess of females.

United States—New Jersey. *Popular Sci. Monthly* **66** (1905): 281–286. **Smith.**
The Mosquito Investigation in New Jersey. By Prof. J. B. Smith. SC.D. *With Illustrations.*

United States—Railways. **Collier.**
United States Railways. Foreign Office, Miscellaneous, No. 627, 1905. Size 9½ × 6, pp. 46. *Price* 2½*d.*

United States—Rice Industry. **Bell.**
Rice Industry in the United States, Foreign Office, Miscellaneous, No. 625. 1905. Size 9½ × 6½, pp. 26. *Price* 2*d.*

United States—Roads. *B. American G.S.* **36** (1904) : 721-735. **Brigham.**
Good Roads in the United States. By A. P. Brigham.
Shows how bad roads have handicapped the American farmers. Their improvement is now held to be merely a matter of time.

United States—Sierra Nevada. *Sierra Club B.* **5** (1905): 211-220. **Gilbert.**
Domes and Dome Structure of the High Sierra. By G. K. Gilbert. *With Illustrations.*
Noticed in the Monthly Record for April (p. 461).

United States—Telegraphs. *National G. Mag.* **15** (1904): 490-494. ———
The United States Government Telegraph and Cable Lines. *With Maps.*
Extracts from a report by General Greely dealing with the newly opened telegraph lines of Alaska and the Philippines. The maps (which bring out clearly the configuration of the countries) include one of Porto Rico.

CENTRAL AND SOUTH AMERICA.

Argentine Republic—Andes. **Hauthal.**
Z. Deutsch. u. Österreich Alpenv. **35** (1904): 30-56.
Gletscherbilder aus der argentinischen Cordillere. Von Prof. R. Hauthal. *With Illustrations.*

Bolivia. *B.S.G. Com. Paris* **26** (1904): 614-619. **Courty.**
Sur les hauts plateaux de Bolivie, le sol et ses habitants. Par G. Courty.

Bolivia and Brazil. **Posnansky.**
Campaña del Acre, La Lancha "Iris," Aventuras y Peregrinaciones. Por A. Posnansky. La Paz, 1904. Size 9 × 6½, pp. 112. *Map and Illustrations.*

Brazil—Migration of Butterflies. *B. Museu Goeldi* **4** (1904): 309-316. **Goeldi.**
Grandiosas migrações de borboletas no valle Amazonico. Pelo Prof. Dr. A. E. Goeldi. *With Illustrations.*

Brazil—Zoology. *B. Museu Goeldi* **4** (1904): 375-406. **Huber.**
Notas sobre a patria e distribuição geografica das arvores fructiferas do Pará. Pelo Dr. J. Huber.

Martinique. *Science* **21** (1905): 352-353. **Eastman.**
Mont Pelée *sive* Mont Pelé. By Dr. C. R. Eastman.
Justifies the former combination on the ground that Pelée has become a substantival proper name.

Martinique. *C. Rd.* **140** (1905): 694-696. **Forel.**
Le cercle de Bishop de la Montagne Pelée de la Martinique. Note de F. A. Forel.

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Les relations sismico-géologiques de la Méditerranée Antillienne. Par F. de Ballore. *With Map.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. *Deutsche Rundschau G.* **27** (1905): 162-166. **Grüner.**
Eine neue transkontinentale Eisenbahn. Von W. Grüner.
On the recent decision to link the northern and southern lines across Central Australia.

Australia—Botany. **Banks and Solander.**
Illustrations of Australian Plants collected in 1770 during Captain Cook's Voyage round the World in H.M.S. *Endeavour*. By the Right Hon. Sir J. Banks, Bart., and Dr. D. Solander, F.R.S. With Determinations by J. Britten. [Part iii.] London: Longmans & Co., 1905. Size 19½ × 13, pp. 77-102. *Charts and Plates. Presented by the British Museum.*
This part completes the volume (Cf. *Journal*, vol. **16**, p. 254; vol. **18**, p. 337).

British New Guinea. ———
British New Guinea. Annual Report for the year ending June 30, 1903. Size 13½ × 8½, pp. 66.

Caroline and Marianne Islands. *Petermanns M.* **51** (1905): 36–39. **Seidel.**
Die Bevölkerung der Karolinen und Marianen. Von H. Seidel.

Dutch New Guinea. **Hille.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **22** (1905): 233–330.
Reisen in West-Nieuw-Guinea. Door J. W. van Hille. *With Map.*
Besides the information collected during the writer's own journeys, this contains some general information on the western part of Dutch New Guinea, and past Dutch relations with it.

Marianne Islands—Guam. *Petermanns M.* **51** (1905): 40–41. **Supan.**
Die Insel Guam. Von Prof. Dr. A. Supan. *With Map.*
The first of a series of papers (with maps) intended to supply accurate information in regard to *islands*, which cannot, as a rule, be adequately represented in our atlases.

POLAR REGIONS.

Antarctic. *Scottish G. Mag.* **21** (1905): 207–210. **Brown.**
Argentine Antarctic Station. By R. N. Rudmose Brown.

Antarctic. *Quarterly J.R. Meteorolog. S.* **31** (1905): 1–14. **Royds.**
Meteorological Observing in the Antarctic Regions. By Lieut. C. W. R. Royds. *Maps and Illustrations.*

Antarctic—Graham Land. *Ymer* **24** (1904): 371–391. **Duse.**
Om Kartan öfver Graham Land. Af S. A. Duse. *With Maps.*
A sketch of the history of the cartography of Graham's Land.

Antarctic—Swedish Expedition. *Norske G.S. Aarb.* **15** (1903–1904): 83–98. **Andersson.**
De vetenskapliga arbetena ombord på Antarctic sommaren 1902–1903 och slädfärden till Snow Hill 1903. Af J. G. Andersson.

Antarctic—Swedish Expedition. *Norske G.S. Aarb.* **15** (1903–1904): 96–108. **Larsen.**
Antarctics sidste Færd. Af Kapt. C. A. Larsen. *With Illustration.*

Antarctic—Swedish Expedition. **Nordenskjöld.**
La G., B.S.G. Paris **10** (1904): 351–362.
Résultats scientifiques de l'expédition antarctique Suédoise (1901–1903). Par O. Nordenskjöld. *With Illustrations.*

Antarctic—Swedish Expedition. **Nordenskjöld.**
Norske G.S. Aarb. **15** (1903–1904): 56–82.
Den svenska sydpolarexpeditionen 1901–03. Af Dr. O. Nordenskjöld. *With Map and Illustrations.*

Arctic. *Norske G.S. Aarb.* **15** (1903–1904): 129–141. **Isachsen.**
Rundt Ellef og Amund Ringnes's lande. Af G. Isachsen. *With Map.*

Arctic. *Smithsonian Rep.*, 1903 (1904): 427–457. **Peary.**
North Polar Exploration: Field Work of the Peary Arctic Club, 1898–1902. By Commander R. E. Peary. *With Map and Illustrations.*
From the manuscript account as read before the Peary Arctic Club.

Arctic—Norsemen. *La G., B.S.G. Paris* **10** (1904): 371–376. **Isachsen.**
Découverte de vestiges nordiques dans l'archipel polaire américain. Par G. Isachsen. *With Map and Plans.*
The members of the second Norwegian Polar Expedition discovered, on two islets in Cardigan strait and Jones sound, small erections of three stones built for the purpose of sheltering the nests of the eider duck. They were of precisely the same character as are still put up for the same purpose in Northern Norway, and the writer attributes their erection to the early Norsemen.

Franz Josef Land—Meteorology. *Meteorolog. Z.* **21** (1904): 547–555. **Hann.**
Einige Ergebnisse der meteorologischen Beobachtungen auf Franz Josefs-Land zwischen 1872 und 1900. Von J. Hann.

Greenland. *Arkiv Matematik, etc., K. Svensk. Vet.-A.* **1** (1904): 609–626. **Åkerblom.**
Expédition de M. A.-G. Nathorst en 1899. Déterminations magnétiques faites au Grönland du nord-est. Par F. Åkerblom.

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Cartography. **Vasconcellos.**

Sociedade de Geographia de Lisboa. Exposição de Cartographia Nacional (1903–1904). Catalogo sob a direcção de Ernesto de Vasconcellos. Lisboa, 1904. Size 9½ × 6½, pp. xxxiv. and 280.

Figure of the Earth. *Ciel et Terre* **25** (1904): 401–416. **Puiseux.**

La notion de la figure de la Terre, de Thalès à Newton. Par P. Puiseux.

Geodesy. *Petermanns M.* **51** (1905): 42–43. **Hammer.**

Ausgleichung des europäischen Längennetzes. Von Prof. Dr. E. Hammer.

Longitude Determination. **Smith.**

Rep. U.S. Coast and Geodetic Surv. (1904), Appendix 4: 257–311.

Telegraphic Longitudes. The Pacific Arcs from San Francisco to Manila, 1903–1904. By E. Smith. *With Map and Illustrations.*

Surveying. *P.I. Civil Engineers* **158** (1904): 361–368. **Crosthwaite.**

Note on Traverse Surveying. By P. M. Crosthwaite.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climate and Morphology. *American J. Sci.* **19** (1905): 165–174. **Penck.**

Climatic Features in the Land Surface. By A. Penck.

Cosmogony. *Petermanns M.* **51** (1905): 43–45. **Friedel.**

Zur Kant-Laplaceschen Theorie. Von J. Friedel.

Geology and Earthquakes. **Ballore.**

B.S. Belge Géologie (Mém.) **18** (1904): 243–268.

Géosynclinaux et régions à tremblements de terre. Esquisse de géographie sismico-géologique. Par F. de Montessus de Ballore.

Geomorphology. *Ann. G.* **13** (1904): 385–400. **Martonne.**

Les enseignements de la topographie. Par E. de Martonne. *Maps.*

Geomorphology. **Passarge.**

Rumpfflächen und Inselberge, von — Passarge. (Sonder-Abdruck aus dem Dezember-Protokoll der Deutschen geologischen Gesellschaft, Bd. 56, Jahrg. 1904.) Berlin. Size 9 × 6, pp. 193–209.

Meteorology. *Meteorolog. Z.* **21** (1904): 324–326. **Hann.**

Ueber die Temperaturabnahme mit der Höhe bis zu 10 km. nach den Ergebnissen der internationalen Ballonaufstiege. Von — Hann.

Meteorology. *Meteorolog. Z.* **21** (1904): 453–458. **Homma.**

Beiträge zur Kenntnis der Temperaturverteilung in der Atmosphäre und ihrer Beziehung zur Witterung. Von J. Homma.

Meteorology. **Marchi.**

Manuali Hoepli. Meteorologia generale, di L. De Marchi. 2ª Edizione. Milano, U. Hoepli, 1905. Size 6 × 4, pp. xiv. and 226. *Maps and Illustrations. Price* L1.50. *Presented by the Publisher.*

Like the other manuals issued by the same publisher, this forms an exceedingly compact and handy summary of the main principles of the science with which it deals.

Oceanography. ———

Conseil Permanent International pour l'Exploration de la Mer. Rapports et Procès-Verbaux des Réunions. Volume ii. Juillet 1903—Juillet 1904. Copenhague: A. F. Høst & Fils, 1904. Size 10½ × 8½, pp. xl., 32, and 72.

Oceanography—Waves. *Rev. Maritime* 163 (1904): 19–25. **Jolivet.**

Observations sur les roulis de la "Foudre" dans la Mousson de Sud-est, pendant les journées des 29, 30 et 31 juillet 1904. Par lieutenant Jolivet.

Seismology. *C. Rd.* **139** (1904): 686–687. **Ballore.**

Sur la coïncidence entre les géosynclinaux et les grands cercles de sismicité maxima. Note de M. de Montessus de Ballore.

Seismology. *C. Rd.* **139** (1904): 780–781, 782. **Lippmann.**

Mesure de la vitesse de propagation des tremblements de terre. Note de G. Lippmann. Sur l'inscription des movements sismiques. By the same.

Soil Temperature. *Meteorolog. Z.* **21** (1904): 399–408. **Woeikof.**
Nachtrag zu den Problemen der Bodentemperatur. Von A. Woeikof. *With Diagrams.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropology—Dwarfs. *Globus* **87** (1905): 121–125. **Schmidt.**
Die Grösse der Zwerge und der sogenannten Zwergvölker. Von E. Schmidt.

Historical—Maps. *Riv. G. Italiana* **12** (1905): 1–7. **Gallois.**
Sui mappemondi del Dalorto e dèl Dulcert. Osservazioni di L. Gallois.

Historical—Portuguese in India. **Viterbo.**
O thesouro do Rei de Ceylão. Memoria apresentada á Academia Real das Sciencias de Lisboa. Por S. Viterbo. Lisboa, 1904. Size 12½ × 9, pp. 68. *Presented by the Author.*
Reproduces an inventory, drawn up by Simão Botelho, of the treasure taken from the king of Ceylon during the expedition of Affonso de Noronha.

Sociology. **Galton and others.**
Sociological Papers. By Francis Galton, E. Westermarck, P. Geddes, E. Durkheim, Harold H. Mann and V. V. Branford. With an Introductory Address, by James Bryce. London: Macmillan & Co., 1905. Size 10½ × 7, pp. xviii. and 292. *Price* 10*s.* 6*d.* *Presented by the Sociological Society.*
Consists mainly of papers read before the newly constituted Sociological Society.

BIOGRAPHY.

Andree. *Globus* **87** (1905): 148. **Andree.**
Kurzer Rückblick auf Richard Andrees literarische Tätigkeit. Von H. Andree.
This number of *Globus* is dedicated to Prof. R. Andree on the occasion of his seventieth birthday, a portrait being given.

Claudius Clavus. *Norske G.S. Aarb.* **15** (1903–1904): 109–128. **Bjørnbo.**
Nordens ældste kartograf. Af Dr. A. A. Bjørnbo.
Noticed in the Monthly Record (*ante*, p. 93).

Kirchhoff. *Deutsch. Rundschau G.* **27** (1905): 230–232. ——
Prof. Dr. Alfred Kirchhoff. *With Portrait.*

Philippi. *An. S. Ci. Argentina* **58** (1904): 145–151. **Hicken.**
Doctor Rodulfo Amando Philippi. Breves apuntes biográficos. C. M. Hicken. *With Portrait.*
Obituary of the well-known German naturalist, long settled in Chile.

GENERAL.

Altitude and Respiration. *C. Rd.* **139** (1904): 1115–1117. **Tissot.**
Les phénomènes physiques et chimiques de la respiration aux grandes altitudes.

Geographical Names. *G. Jahrb.* **27** (1) (1904): 113–176. **Nagl.**
Ueber die Fortschritte der geographischen Namenkunde. Von J. W. Nagl.

German Colonies. ——
Jahresbericht über die Entwickelung der deutschen Schutzgebiete in Afrika und der Südsee im Jahre 1903–1904. Mit einem Bande Anlagen. (Beilage zum Deutschen Kolonialblatt 1905.) Berlin: E. S. Mittler und Sohn, 1905. Size 12 × 8½, pp. 114, 494.

Mountaineering. *Sitzb. K.P.A.W. Berlin* (1904): 1041–1042. **Durig and Zuntz.**
Bericht über einige Untersuchungen zur Physiologie des Menschen im Hochgebirge. Von Prof. A. Durig u. Prof. N. Zuntz.

Terminology. *Science* **21** (1905): 28–29. **Gilbert.**
Style in Scientific Composition. By G. K. Gilbert.
Discusses the question of the introduction of new technical terms in physical geography, some of which, *e.g.* "youthful," "mature," etc., the writer upholds.

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Bohemia. **Rauchberg.**

Sprachenkarte von Böhmen. Von Dr. Heinrich Rauchberg. Scale 1 : 500,000 or 7·9 stat. miles to an inch. Vienna: R. Lechner, [1905]. *Price* 4*k.* 50*h.*

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Cardiganshire, XI. 13; XII. 14; XIV. 15, 16; XV. 4, 5, 13, 14, 15, 16; XVI. 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 13, 14; XXI. 1, 3, 8; XXII. 5. **Devonshire**, XI. 15; XV. 3, 4, 7, 8; XVI. (1 and 5), 6, 11, 12, 13, 14; XXII. 15; XXIII. 15; XXV. 6, 9, 10, 13, 14; XXVIII. 9; XXIX. 13, 14, 15, 16; XXX. 13, 15, 16; XXXI. 15, 16; XXXV. 2; LIV. 6, 7, 8, 10, 11, 12; LXVII. 14, 15, 16; LXVIII. 13, 14, 15, 16; LXXVIII. 6, 7, 8, 10, 11; LXXIX. 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 13, 15, 16; LXXXI. 1, 5, 9, 13; XCI. 6, 7; **Lincolnshire**, XCV. 2, 3, 4, 5, 9, 10, 13, 14, 16; XCVI. 1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 16; XCVII. 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16; XCVIII. 1, 5, 7, 8, 10, 11, 12, 14; CVII. 9, 10, 14; CVIII. 1, 2, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15; CXVII. 16. **Norfolk**, LXVIII. 11; LXIX. 7; LXXX. 3, 4; LXXXI. 1, 5, 12, 15, 16; LXXXII. 6, 9, 11, 12, 15, 16; XCI. 3, 4; XCII. 3, 4; XCVI. 1, 2, 3, 4, 7, 8, 12, 16; XCVII. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XCVIII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14; XCIX. 1, 10; CVI. 2, 3, 4; CVII. 1, 2. **Suffolk**, VIII. 6, 7, 8, 10, 12, 14, 16; IX. 10, 13, 14, 15; XVII. 1, 2, 3, 4; XVIII. 1, 2, 3. **Warwickshire**, XXI. 3; XXXI. 7, 13, 14, 15; XXXVII. 1, 2, 3, 5, 6, 7, 9, 10, 11, 15; XXXVIII. 6; XLIII. 1, 2, 3, 11, 15; XLIX. 3. **Yorkshire** (First Revision of 1891 Survey), CCLXXXVIII. 3, 4, 8; CCLXXXIX. 1, 2, 6; CCXCV. 1. 3*s. each.*

(*E. Stanford, London Agent.*)

England and Wales. **Geological Survey.**

1-inch maps (New Series). Colour printed.

Newport (Mon.), 149. Drift edition. 1*s.* 6*d.*

(*E. Stanford, London Agent.*)

Europe. **Ebbecke.**

Ebbeckes Verkehrskarte. Scale 1: 600,000 or 9·5 stat. miles to an inch. Nos.: 8, Provinz Schleswig-Holstein, 7 Auflage; 9, Königreich Sachsen, 7 Auflage; 10, Elsass-Lothringen, 3 Auflage; 11, Grossherzogtümer Mecklenburg-Strelitz, 2

Auflage; 12, Grossherzogtum Hessen, 2 Auflage; 15, Provinz Sachsen und Thüringen, 5 Auflage.—Scale 1 : 2,000,000 or 31·5 stat. miles to an inch. No. 13, Westliche Russland, 3 Auflage.—Scale 1 : 450,000 or 7·1 stat. miles to an inch, No. 14, Schweiz, 3 Auflage. Lissa: Friedrich Ebbecke, [1905].

Europe. **International Geological Commission.**

Carte géologique international de l'Europe. Scale 1 : 1,500,000 or 23·7 stat. miles to an inch. Livraison v. Berlin: Dietrich Reimer, 1905. *Presented through the Royal Society, London.*

This is the fifth issue of the geological map of Europe proposed by the International Geological Congress at Bologna in 1881, and executed conformably with the decision of an International Commission, with the approval of the various governments, under the direction of MM. Beyrich, Hanchecorne, and Beyschlag.

With the publication of this part, thirty sheets out of the total of forty-nine, of which this map will finally consist, have been issued. Four of the present sheets, 43 (A VII.), 44 (B VII.), 45 (C VII.), 46 (D VII.), include the North African regions bordering on the Mediterranean, and so are strictly outside the limits of the map, and, for the want of reliable geological data, they must be considered in parts but very approximate. Sheet 27 (F IV.) gives south-east European Russia, including the lower course of the Volga and the Don. The fourth part of the map was published early in 1902.

Europe—Central. **Flemming and Merkel.**

Grosser Atlas der Eisenbahnen von Mittel-Europa. New Bearbeitet und Vervollständigt von M. Flemming und G. Merkel. Herausgegeben von Alexander Duncker, xv Auflage. Leipzig: Verlag für Börsen- und Finanzliteratur, 1905.

The fact that this atlas has now reached its fifteenth edition speaks well for its merits and general utility. It is divided into three sections, the first dealing with the German Empire and Switzerland; the second, Austria-Hungary, Servia, the Balkan Peninsula, Greece, and Italy; and the third with France, Belgium, the Netherlands, Sweden and Norway, Denmark and Russia. The maps showing the railways are most complete in the information they contain, and in addition to these there is an index to places, and statistics in tabular form, amounting altogether to fifty-four pages.

Europe—Central. **Ihne.**

Phaenologische Karte des Frühlingseinzugs in Mitteleuropa. Von E. Ihne Scale 1 : 3,400,000 or 53·6 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Tafel 9. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

Europe—Central. **K. Preussische Landesaufnahme.**

Topographische Specialkarte von Mittel-Europe. Herausgegeben von der Kartographischen Abtheilungen der Königlichen Preussische Landesaufnahme. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Sheets: 250, Nauen; 251, Berlin; 277, Madgeburg; 629, Walenstadt; 331, Düsseldorf; 383, Valenciennes. Berlin, 1904. *Price* 1·00 *mark each sheet.*

Germany. **Andresen and Bruhn.**

Geographisch-statistische Karten von Deutschland, bearbeitet und gezeichnet von H. Andresen und H. Bruhn. No. 1, Sprachenkarte. Scale 1 : 1,200,000 or 18·9 stat. miles to an inch. Brunswick: Hellmuth Wollermann.

The first of a series of coloured geographical and statistical wall-maps of Germany, suitable for schools. It shows by colouring the general distribution of languages in the German Empire, and is clear and instructive. When complete the series will consist altogether of twelve maps, and ought to be of decided educational value.

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abtheilungen der Königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1·6 stat. miles to an inch. Sheets: (plain) 295, Furstenwalde; (brown hills and contours) 144, Osten; 174, Varel; 203, Bunde; 209, Amelinghausen; 210, Lüneburg; 238, Uelzen; 262, Celle; 263, Wittingen; 284, Lübbecke; 285, Minden; 286, Hannover; 287, Lehrte; 288, Braunschweig; 309, Lemgo; 310, Hameln; 311, Hildesheim; 312, Wolfenbüttel. Berlin, 1904. *Price* 1·50 *mark each sheet.*

Lake Constance. **Becker.**

Karte von Bodensee und Rhein mit den angrenzenden Gebieten von Baden, Württemberg, Bayern, Österreich und der Schweiz, bearbeitet von Prof. F. Becker. Herausgegeben vom Verein für Geschichte des Bodensee's und seiner Umgebung

und dem Bodensee-Verkehrsverein. Scale 1 : 125,000 or 1·9 stat. mile to an inch. Bern: H. Kümmerly & Frey, [1905].

Sweden. **Sveriges Geologiska Undersökning.**

Sveriges Geologiska Undersökning. Series Aa. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheets: 119, Sommenäs; 121, Sköfde; 124, Björneborg; 127, Loftahammar; 128, Skagersholm. Series Ac. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: 5, Oskarshamn; 8, Mönsteräs. Series Ala. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Berggrundskator i Skalan. Sheets 1 and 2.

ASIA.

Dutch East Indies. **Stemfoort and Siethoff.**

Atlas der Nederlandsche Bezittingen in Oost-Indië, naar de nieuwst Bronnen samengesteld en aan de regeering opgedragen door J. W. Stemfoot en J. J. ten Siethoff, Kapiteins van den Generalen staf van het Nederlandsch-Indisch leger. Gereproduceerd, op last van het Departement van Koloniën, aan de Topographische inrichting te 's Gravenhage, onder leiding van den Directeur C. A. Eckstein. Sheet (new edition) 3, West Java. Scale 1 : 500,000 or 7·9 stat. miles to an inch. The Hague, 1905.

Manchuria. **Favre.**

Le Théatre de la Guerre en Mandchourie d'après la carte militaire russe dressée en 1902 par le Colonel Khvostoff et le Lieut. Lubizky. Croquis publié par le Colonel Camille Favre. Scale 1 : 853,600 or 13·5 stat. miles to an inch. Geneva: Librairie Georg, 1905.

An extremely rough sketch-map of Manchuria in black, taken from the Russian map mentioned below.

Manchuria. **Khvostoff and Lubizky.**

Map of South Manchuria. Mukden District and Kwantung Province. Compiled by Lieut.-Colonel Khvostoff and Lieut. Lubizky. Scale 1 : 840,000 or 13·3. stat. miles to an inch. 4 sheets. St. Petersburg: Military Topographical Department, 1903.

A Russian military map, in colours, of the seat of war in Manchuria and the Kwangtung Province, compiled from information obtained by Russian officers, and now being used in the campaign in the Far East. Inset plans of the principal towns are given.

Manchuria. **Topographical Section, General Staff.**

Map of the country round Mukden. Scale 1 : 420,000 or 6·6 stat. miles to an inch. Revised May, 1905. Map of the country north of T'ieh-ling. Scale 1 : 420,000. Revised May, 1905. Map of the country south of Harbin. Scale 1 : 420,000. May, 1905. London: Topographical Section, General Staff, War Office, 1905. *Price 2s. each. Presented by the Director of Military Operations.*

These maps have been revised and corrected up to date. Hills have also been added.

Siberia. **Topographical Section, General Staff.**

Map of the country round Vladivostok. Scale 1 : 630,000 or 9·9 stat. miles to an inch. London: Topographical Section, General Staff, War Office, 1905. *Price 2s. Presented by the Director of Military Operations.*

Yangtse-Kiang. **Hourst.**

Chine. Haut Yang-tse entre Itchang et Suifou et ses affluents en amont de Suifou d'après le levé fait de 1901 à 1903 sous la direction de M. Hourst, par MM. Bramaud de Boucheron, Térisse, Monnot et Marquis. Scale 1 : 50,000 or 1·3 inch to a stat. mile. 21 sheets and index. Paris: Service Hydrographique de la Marine, 1905. *Price 24 fr.*

A considerable amount of survey work has been carried out in recent years in the upper Yang-tse valley, both by English and French expeditions. Among the former may be mentioned the surveys of Majors Ryder and Davis, and those of Colonel Manifold's expeditions, accounts of which have appeared in the *Geographical Journal*. The present chart has been drawn from surveys made under the direction of Lieut. Hourst and other officers of the French Navy, between the years 1901 and 1903, the positions being deduced from observations taken at Ichang, Chungking, and Suifu by Père Chevalier in 1897 and 1898. The courses of the Hong Kiang, Kincha Kiang

from Ping Chan Hien to Koan Che, and of the Fu Ho from Kiating to Kiang Keu, have been laid down from the survey of the English Pilot Plant. The chart consists altogether of twenty-one sheets on the scale of 1 : 50,000, and shows a considerable amount of detailed information concerning the course of the Yang-tse, including sand-banks, direction of currents, and soundings.

AFRICA.

Africa. **"Les Missions Catholiques."**

Carte des Missions Catholiques en Afrique. Scale 1 : 10,000,000 or 157·8 stat. miles to an inch. Supplement to the journal *Les Missions Catholiques*, May 12, 1905. Paris, 1905.

On this general map of Africa the present position of Roman Catholic missionary enterprise is clearly shown. The various bishoprics, vicariats, préfectures and missions are indicated, mission stations being shown by a red line under the name of the place. There are statistical tables at the bottom of the map giving detailed information as to the number of missionaries, schools, etc.

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheets: 7, Tripoli; 8, Ben-Ghazi; 14, Sella; 15, Aujila; 58 and 70, Freetown; 73, Kotonu. London: Topographical Section, General Staff, War Office, 1904–05. *Price 2s. each sheet. Presented by the Director of Military Operations.*

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets: Southern Nigeria, 74-J, 74-N. London: Topographical Section, General Staff, War Office, 1905. *Price 1s. 6d. each sheet. Presented by the Director of Military Operations.*

Assuan Cataract. **Egyptian Survey Dept.**

Map of the First or Assuan Cataract. Scale 1 : 10,000 or 6·3 inches to a stat. mile. 6 sheets. Cairo: Survey Department, Public Works Ministry, 1904. *Presented by the Director-General, Egyptian Survey Department.*

This is a revised edition of the map issued in 1900, which was noticed in the November *Journal* of that year.

German East Africa. **Sprigade and Moisel.**

Karte von Deutsch-Ostafrika. Begonnen unter Leitung von Dr. Richard Kiepert, fortgesetzt unter Leitung von Paul Sprigade und Max Moisel. Scale 1 : 300,000 or 4·7 stat. miles to an inch. Sheet E 3, Rukwa-See. Berlin: Dietrich Reimer (Ernst Vohsen), 1905. *Presented by Herr Max Moisel.*

This sheet includes the region immediately to the north of Lake Rukwa, and extends from lat. 7° S. to 8° 30′ S., and from long. 32° to 34° E. Explorers' routes are shown, and all available information has been utilized, but many districts shown on the sheet are entirely unexplored. The sheet is accompanied by letterpress giving the list of authorities consulted.

Morocco. **Theuveny.**

Carte du Maroc, dressée d'après les documents les plus récents. Scale 1 : 1,500,000 or 23·7 stat. miles to an inch. Paris: Louis Theuveny, [1905]. *Price 1 fr.*

A cheap general map of Morocco, giving a useful explanation of Arabic terms and abbreviations employed.

Togo. **Sprigade.**

Die Umgebung der Station Atakpame, bearbeitet von P. Sprigade. Scale 1 : 100,000 or 1·6 stat. mile to an inch. *Mitteilungen aus den deutschen Schutzgebieten*, Band xviii., Karte 2. Berlin, 1905. *Presented by Herr P. Sprigade.*

AMERICA.

Argentine Republic. **Director-General de Correos y Telégrafos.**

Carta de las Comunicaciones Postales y Telegráficas confeccionada según los datos, observaciones y exploraciones hechas por la Dirección General de Correos y Telégrafos. Scale 1 : 2,225,000 or 35·1 stat. miles to an inch. 3 sheets. Buenos Aires, 1904.

This is an official postal and telegraph map of the Argentine Republic, and upon

these matters it contains much information. As a specimen of cartography it is far from satisfactory, and in parts is so confused that the names are almost illegible. This is chiefly owing to the attempt to show the mountains by shading, which in a map of this kind is generally a mistake.

Argentine Republic. **Ministerio de Obras Publicas, Buenos Aires.**

Mapa de los Ferro Carriles de la Republica Argentina. Scale 1 : 2,500,000 or 39·4 stat. miles to an inch. Buenos Aires: Ministerio de Obras Publicas, 1905.

Canada. **Topographical Surveys Branch, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Battleford Sheet (267), west of Third meridian, revised to March 30, 1905. Ottawa: Topographical Surveys Branch, Department of the Interior, 1905. *Presented by the Topographical Surveys Branch, Ottawa.*

Costa Rica. **International Bureau of American Republics.**

Map of Costa Rica from official and other sources. Prepared in the International Bureau of the American Republics, W. W. Rockhill, Director. Scale 1 : 792,000 or 12·5 stat. miles to an inch. Washington, 1903.

One of the series of general maps of Central America published by the U.S. International Bureau of the American Republics. As is the case with the other maps of the series, much useful information is given, especially as regards the navigability of the rivers and mining districts. The boundary between Panama and Costa Rica, as laid down on this map, after running west from Mona Point for about 18 miles, is shown as taking a southerly course, and thus gives to Costa Rica all the upper basin of the Rio Sixola. As regards the topographical features, as much of the country is entirely unsurveyed, a great deal is, of course, hypothetical or most approximate.

Paraguay. **Romero.**

Mapa de la Republica del Paraguay. Por C. Romero. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Asuncion: Departamento General de Ingenieros, 1904.

So much of the Republic of Paraguay still remains unexplored, that on a map on the scale of 1 : 1,000,000 many districts appear entirely blank. Upon the Chaco region to the north-west of the map, with the exception of the green tint with which it is coloured, there is practically nothing shown. However, there are so few maps of Paraguay that any recent one that is at all reliable is welcome. There is a useful plan of Asuncion in the lower left-hand corner of the map.

AUSTRALASIA.

Western Australia. **Dept. of Lands and Surveys.**

Map of Western Australia. Scale 1 : 1,584,000 or 25 stat. miles to an inch. 4 Sheets. Perth: Department of Lands and Surveys, 1903. *Presented by the Agent-General for Western Australia.*

This is a useful general map of Western Australia, compiled from the latest information. It is printed in colours, and shows political divisions, goldfields, explorers' routes, agricultural areas, railways, telegraphs, stock routes, wells, etc. An outline of England and Wales is drawn upon the map to show proportional areas.

GENERAL.

French Colonies. **Mager.**

Nouvel Atlas Colonial. Par Henri Mager. Supplément aux *Colonies Françaises.* Paris: Ernest Flammarion, [1905]. *Price* 3 *fr.* 50.

This atlas includes the maps of Mager's 'Atlas d'Algérie et Tunisie' and the 'Atlas d'Afrique Occidentale' which have before been published separately, with the addition of others of the French colonies, not included before. As a cheap general atlas of the French colonies, it will doubtless be useful. There are altogether thirty-eight sheets of maps, besides numerous inset plans and diagrams in the letterpress.

CHARTS.

Liverpool Bay. **Belam and Ashton.**

Chart of Liverpool Bay. Scale 1 : 36,000 or 1000 yards to an inch. Surveyed by Commander H. Belam, R.N., Marine Surveyor, and H. G. G. Ashton, Assistant

Marine Surveyor, Mersey Docks and Harbour Board. Liverpool, 1904. *Presented by H. G. G. Ashton, Esq.*

This chart has been revised up to date.

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for June, 1905. London: Meteorological Office, 1905. *Price 6d. Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for June, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

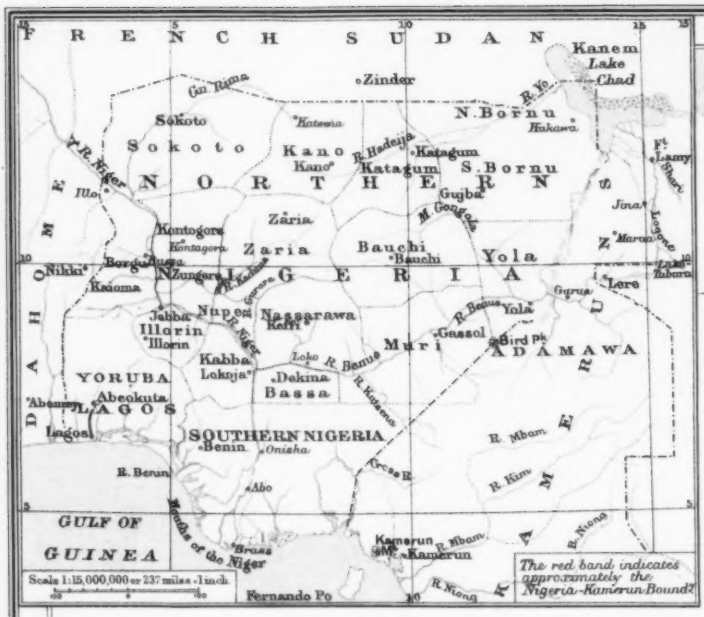
Nigeria. **O'Neill.**

104 photographs of Nigeria, taken by Lieut. F. R. O'Neill. *Presented by Lieut. F. R. O'Neill.*

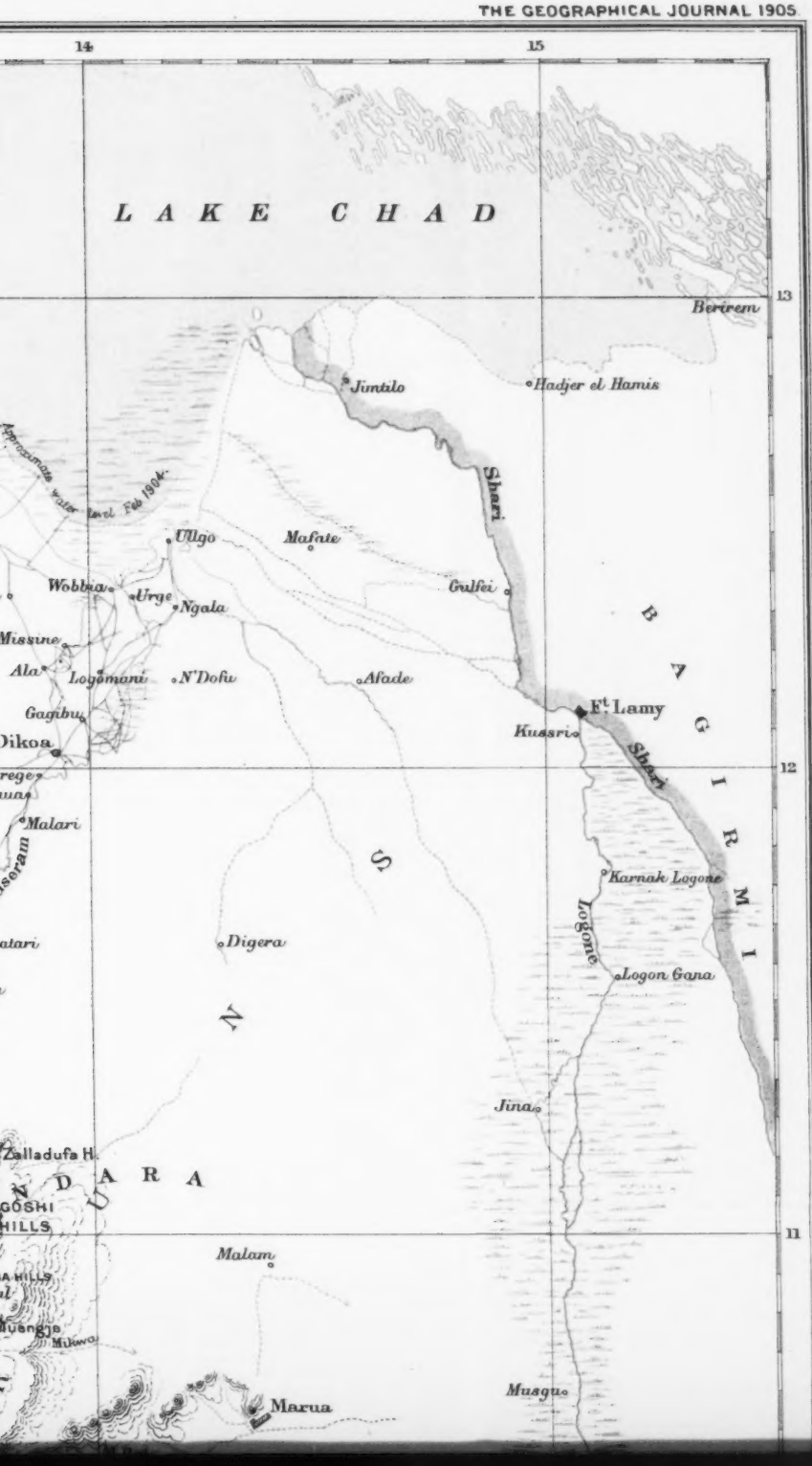
These valuable photographs have been presented to the Society by a son of Consul H. E. O'Neill, of Mozambique, well known to this Society on account of his important geographical explorations in South-East Africa in years past. Lieut. F. R. O'Neill is now serving under General Sir F. Lugard in Northern Nigeria, and in the course of his duties has found time and opportunity to do some good geographical work, to better qualify himself for which he passed through the Society's course of instruction in practical astronomy and surveying last year, and obtained the diploma. The photographs, the titles of which are mentioned below, were taken by Lieut. O'Neill in 1903, during his journeys in the little-known district of Central Northern Nigeria. They are Kodak panoramic views, mounted in albums, and carefully described.

(1) A bush road; (2) A bush village; (3) A bush path; (4 and 5) Carriers crossing stream; (6) The Gurara river; (7 and 8) Ringa; (9) Natives platting grass; (10) Carriers going through thick bush; (11) Crossing river; (12 and 13) Paiko; (14) and 15) Market-place, Paiko; (16) Dye-pits, Paiko; (17) View from hills; (18) View of open country; (19) Camp; (20 and 21) Village near Keffi; (22) Small boy playing "molo;" (23) View inside Keffi; (24) King's palace wall, Keffi; (25–28) On the march; (29) Small village in the bush; (30) A halt in a village; (31) Village street; (32) Camp outside village; (33) Bush; (34) Crossing a village; (35) Men washing in pool; (36) Distant view of hills; (37) Steep mass of rock with perpendicular sides; (38 and 39) Unwalled village; (40) A village in the Gwari country; (41) Village with double wall and ditch; (42) A village built on the summit of a rocky hill; (43–45) Village of Boso; (46) Hausa children; (47) Village divided in compounds by grass-platted walls; (48a) Tent in the bush; (49, 52, and 70) Bungalow, Zungeru; (50) Officers' mess, Zungeru; (51) Tennis court; (53) N.C.O.'s bungalow; (54–56) The king of Kano under escort; (57) Recruits drilling; (58) Parade before leaving on Kano expedition; (59) Leaving Zungeru; (60) Behind the officers' lines, Zungeru; (61) Compulsory washing; (62 and 63) Bridge over Dago river; (64) Group of convicts leaving gaol; (65 and 66) Public offices, Zungeru; (67) The hospital and doctor's bungalow, Zungeru; (68) Soldiers' quarters, Zungeru; (69) The market, Zungeru; (71) The Niger Company's stores and railway station, Zungeru; (72) Veranda of bungalow, Zungeru; (73 and 74) Lieut. O'Neill's Zungeru big game heads; (75) Lieut. Peek; (76) Major Cubitt crossing bridge over Dago river; (77–79) Road clearing; (80) Men making camp in bush; (81 and 82) Forcados river; (83 and 93) Sir F. Lugard's yacht *Corona;* (84) A village in the delta; (85) The river-bank; (86) A southern Nigerian station in the delta; (87) A village on the banks of the Niger; (88 and 91) View of the Kaduna river; (89) A steel canoe; (90) A village near Bida, on the Kaduna; (92) A caravan from Sokoto crossing the Kaduna river; (94) Native boys in canoes waiting for bottles to be thrown from steamer; (95) A halt at Katcha; (96) A halt at Egga; (97) Colonel Morland and Mr. Wallace leaving Lokoja; (98) A village in the delta; (99) Canoe on Kaduna river.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.



Note. *The region between Yola and L. Chad including the Nigeria-Kamerun Boundary, is taken from Col. Jackson's Survey. The Shari R., Lake Tuburu &c. is from Capt. E. Lenfant's survey as shown on the map in his book "La Grande Route du Chad". Between these two surveys the map has been filled in from Sheet N° 4 of the "Grosser Deutscher Kolonialatlas".*


14
15
LAKE CHAD
13
Berirem
Jimtilo
Hadjer el Hamis
Approximate water level Feb 1904
Shari
Ullgo
Mafate
Wobbia
Urge
Ngala
Gulfei
Missine
Ala
Logomani
N'Dofu
Afade
Gagibu
Dikoa
Ft. Lamy
Kusseri
Shari
12
Malari
Karnak Logone
Logone
Digera
Logon Gana
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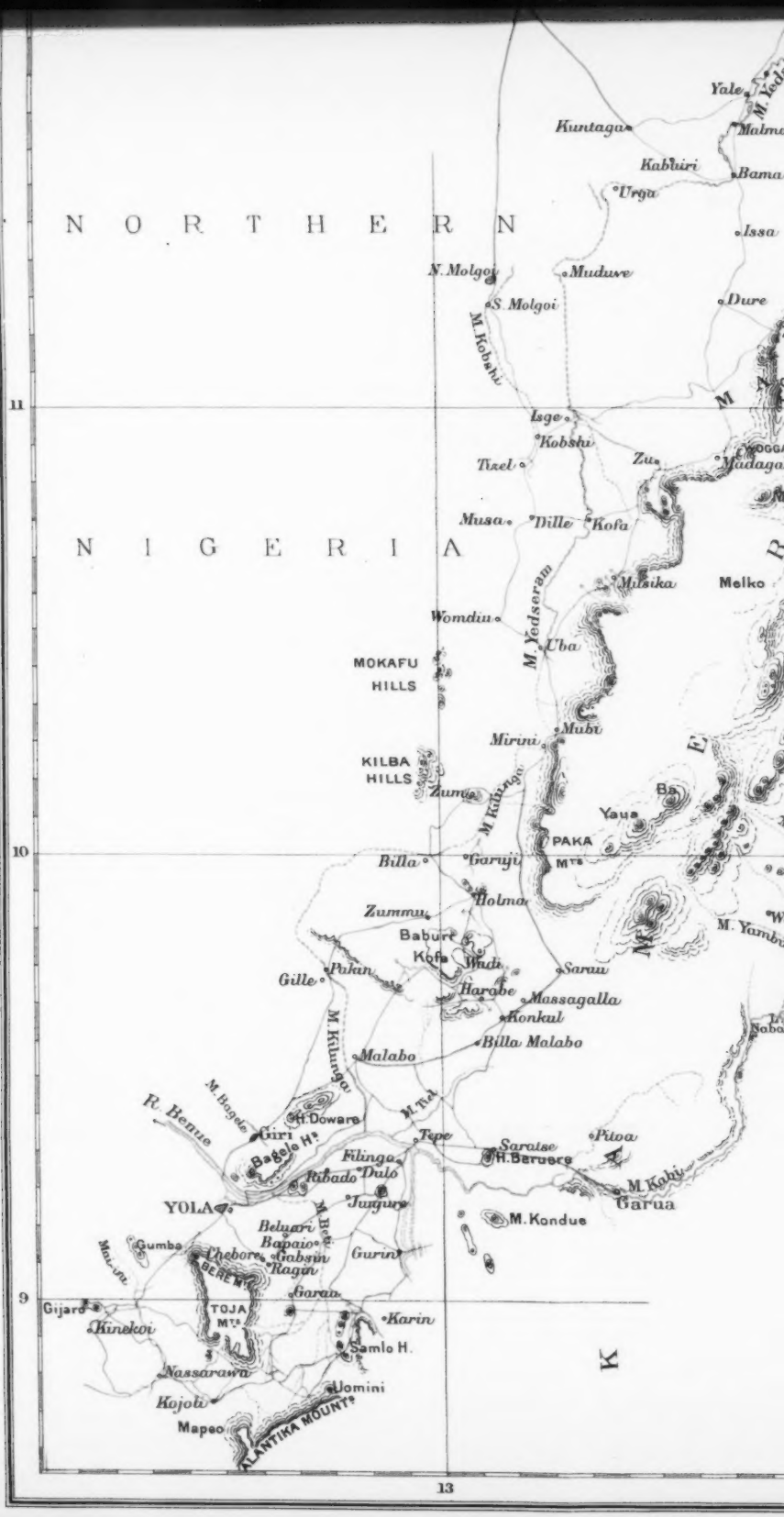

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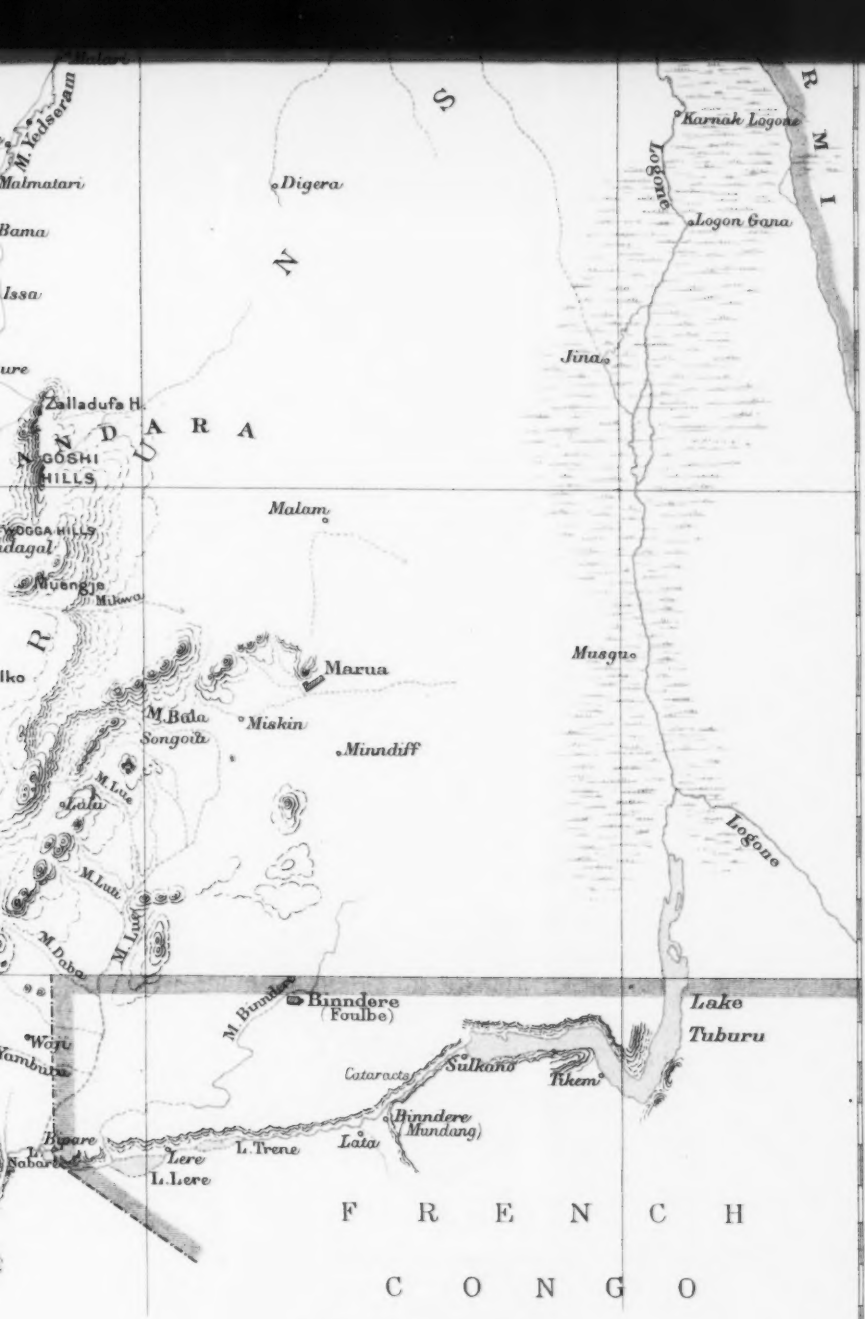


WEST AFRICA.

Map of the
NIGERIA-KAMERUN BOUNDARY SURVEY.

to illustrate the paper by

COLONEL L. JACKSON, R.E.

Scale 1 : 1,500,000 or 23·7 stat. miles = 1 inch.

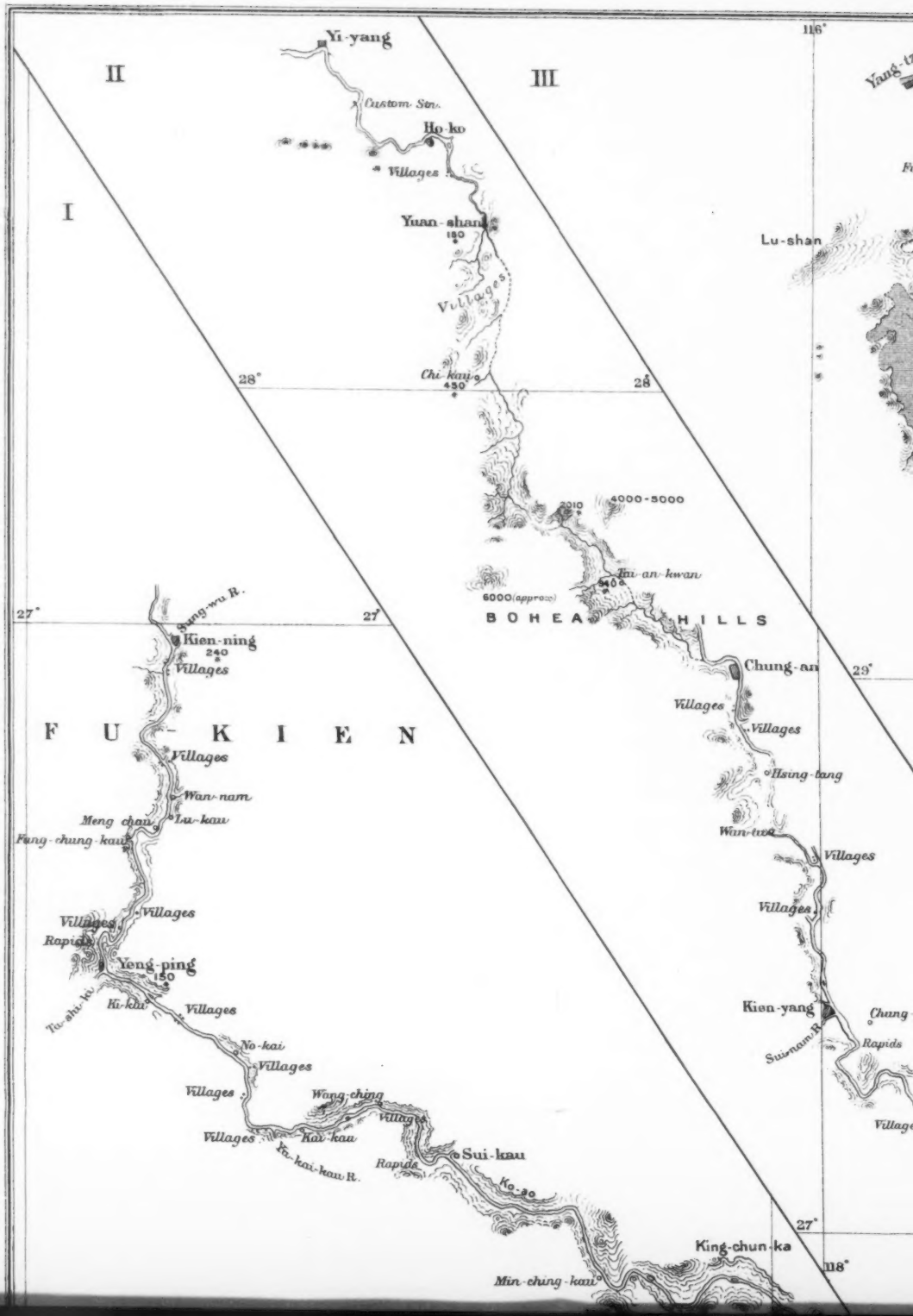
10 5 0 10 20 30 40 50

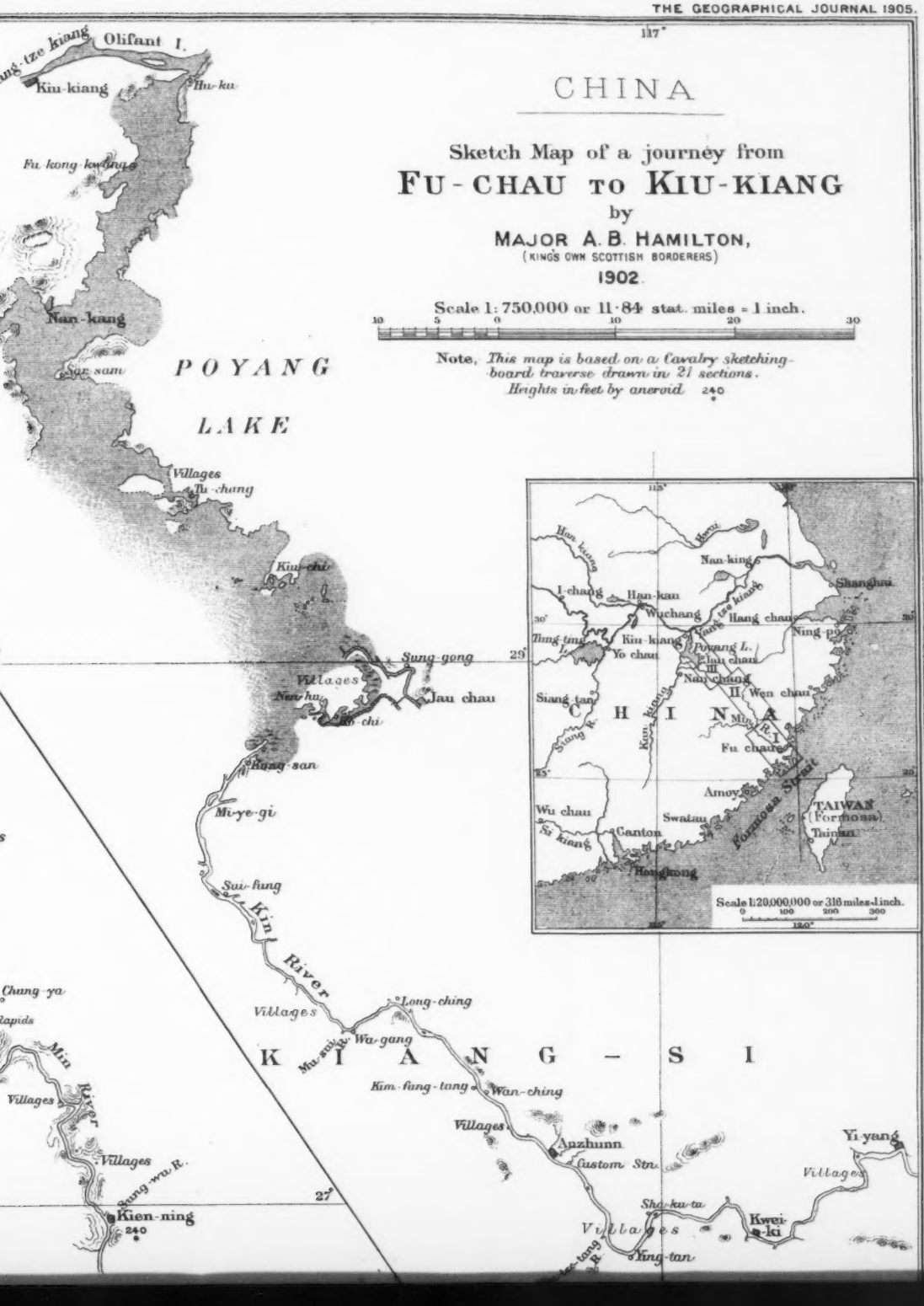
Route of Colonel Jackson's Expedition ———

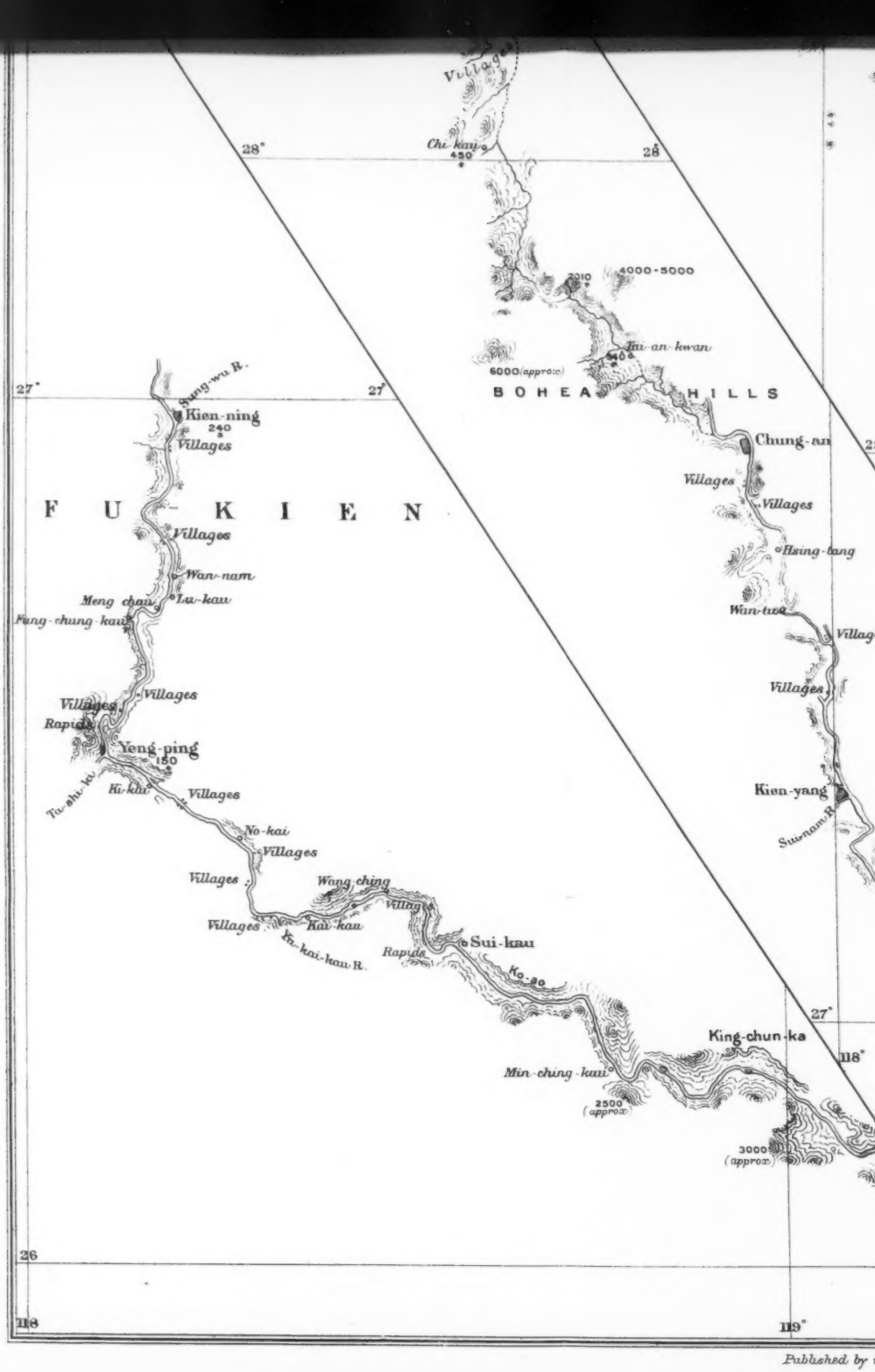
11 10 9

14 15

Royal Geographical Society


II
III
I
Yi-yang
Custom Stn.
Ho-ko
Villages
Yuan-shan
180
Villages
Chi-kau
450
28°
28°
Lu-shan
4000-5000
2010
Tu-an-kwan
6000 (approx)
BOHEA HILLS
Chung-an
Villages
Villages
Hsing-tang
Wan-tsz
Villages
Villages
Kien-yang
Chung
Rapids
Sui-nam R.
Villages
27°
Sung-wu R.
Kien-ning
240
Villages
F U - K I E N
Villages
Wan-nam
Meng chau
Lu-kau
Fang-chung-kau
Villages
Villages
Rapids
Yeng-ping
150
Ki-kau
Villages
Ta-shi-ku
No-kai
Villages
Villages
Wang-ching
Villages
Villages
Kay-kau
Yu-kai-kau R.
Rapids
Sui-kau
Ko-30
King-chun-ka
Min-ching-kau
27°
118°


CHINA
Sketch Map of a journey from
FU-CHAU TO KIU-KIANG
by
MAJOR A. B. HAMILTON,
(KING'S OWN SCOTTISH BORDERERS)
1902.
Scale 1: 750,000 or 11·84 stat. miles = 1 inch.
10 5 0 10 20 30
Note. This map is based on a Cavalry sketching-board traverse drawn in 21 sections.
Heights in feet by aneroid.
240
117°
Olifant I.
Kiu-kiang
Hu-ku
Fu kong kwang
Nan-kang
Sze sam
POYANG
LAKE
Villages
Tu chang
Kiu-chi
Sung-gong
Villages
Nan-hu
Jau chau
Kung-san
Mi-ye-gi
Sui-fung
Kin River
Villages
Long-ching
Ma-sou-k.
Wa-gang
KIANG-SI
Kim-fung-tang
Wan-ching
Villages
Anzhunn
Custom Str.
Yi-yang
Villages
Sha-ku-ta
Villages
Kwei-ki
Yung-tan
Chung-ya
Rapids
Min River
Villages
Villages
Rung-wu R.
Kien-ning
240
27°
25°
Han kiang
Henri
Nan-king
Shanghai
I-chang
Han-kau
Wuchang
Hang chau
Ning-po
Tung ting L.
Kiu-kiang
Poyang L.
Yo chau
Nan-chang
Jau chau
Wen chau
Siang tan
Siang R.
Kan kiang
CHINA
Min R.
Fu chau
Amoy
Formosa Strait
TAIWAN (Formosa)
Wu chau
Si kiang
Canton
Swatau
Tainan
Hongkong
Scale 1:20,000,000 or 316 miles-1 inch.
0 100 200 300
120°

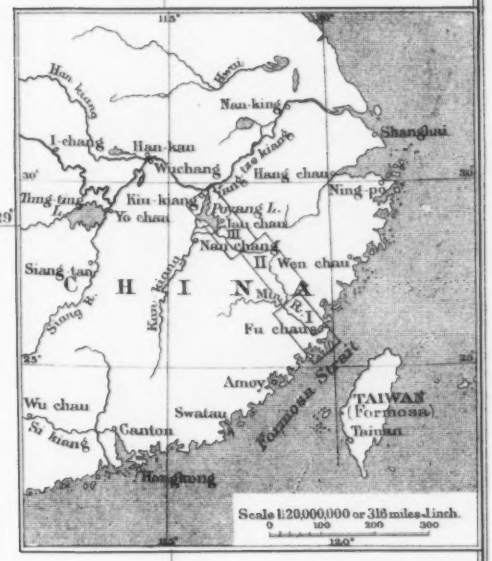


Published by

Scale 1: 750,000 or 11·84 stat. miles = 1 inch.

10 5 0 10 20 30

Note, *This map is based on a Cavalry sketching-board traverse drawn in 21 sections.*
Heights in feet by aneroid. 240



POYANG LAKE

Villages
Tu-chung
Kiu-chi
Sung-gong
Villages
Nan-hu
Jau chau
Kang-san
Mi-ye-gi
Villages
Sui-fung
Kin River
Long-ching
Villages
Wa-gang
Mu-zui R.
KIANG-SI
Kim-fung-tang
Wan-ching
Villages
Anzhunn
Custom Stn.
Yi-yang
Villages
Sha-ku-tu
Villages
Kwei-a-ki
Ying-tan
Yen-ze-tang R.
Chung-ya
Rapids
Min River
Villages
Villages
Sung-wu R.
Kien-ning
240
27°
118°
Wogo
WUFU
Kushan 2900
FU-CHAU
MIN RIVER
Nantai
NANTAI I.
Pagoda Anch.
26°
1900
117°
29°
115°

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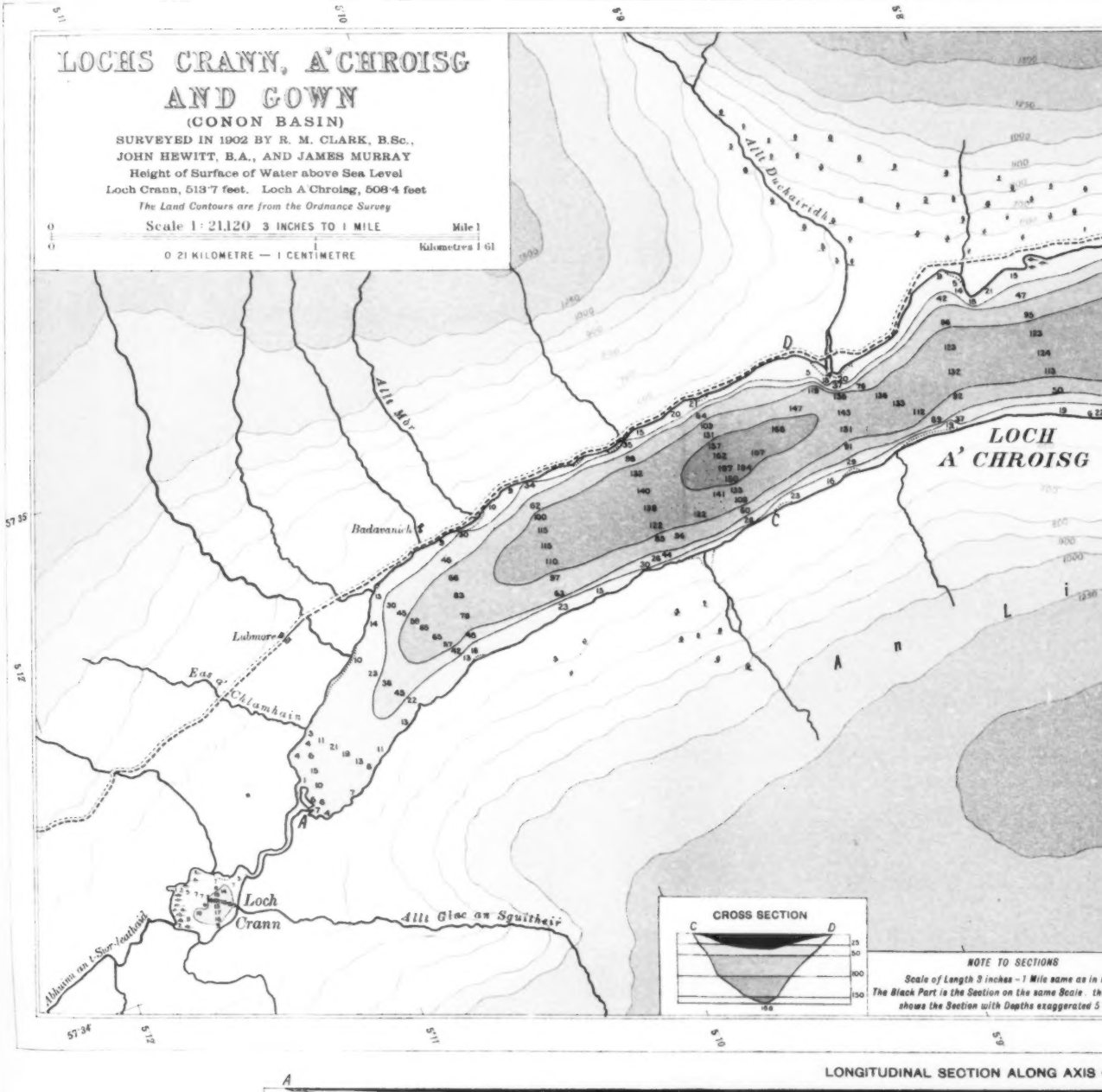
BATHYMETRICAL SURVEY OF THE FRESH

UNDER THE DIRECTION

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND



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ESH-WATER LOCHS OF SCOTLAND

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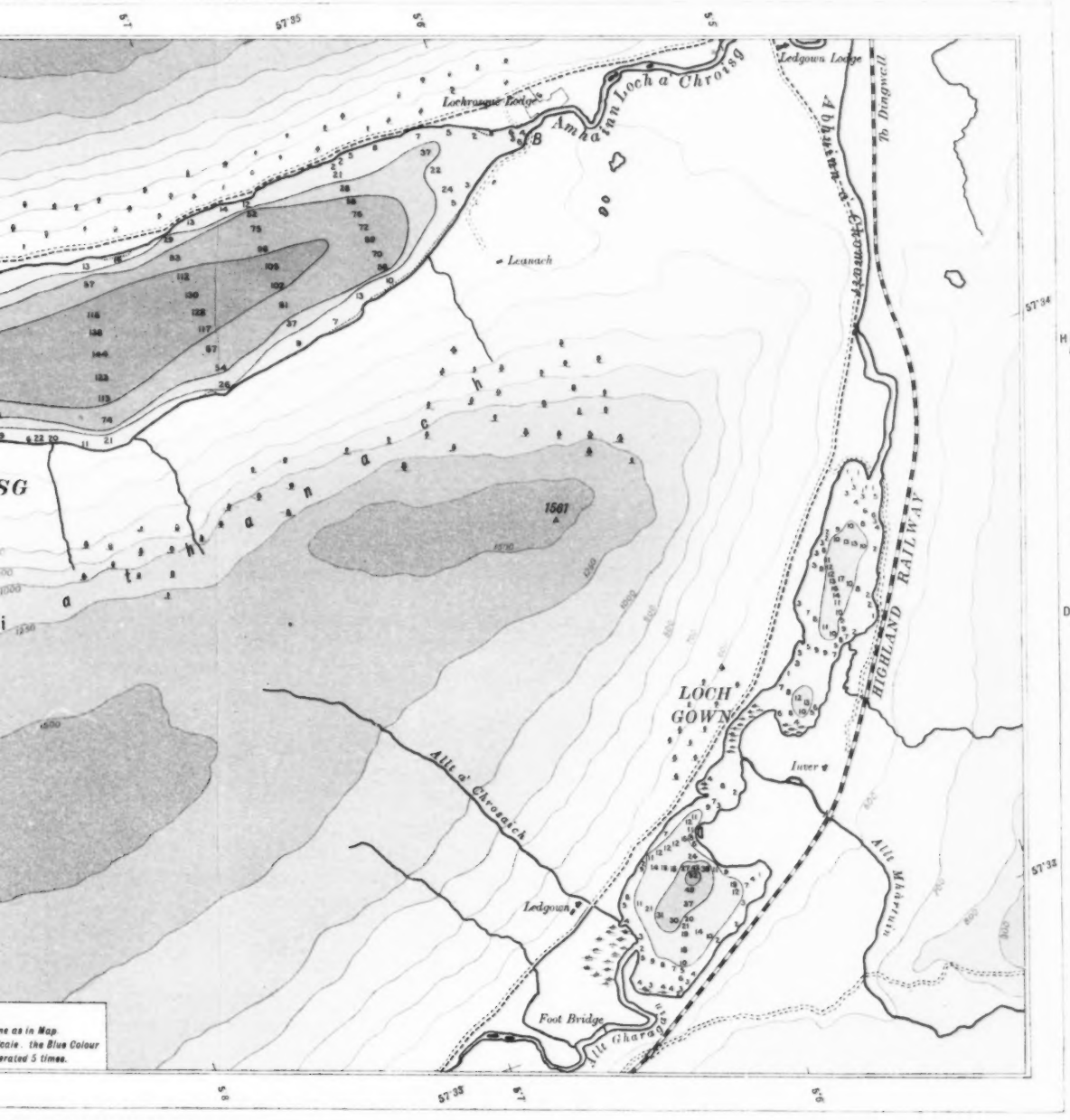
AND LAURENCE PULLAR, F.R.S.E.



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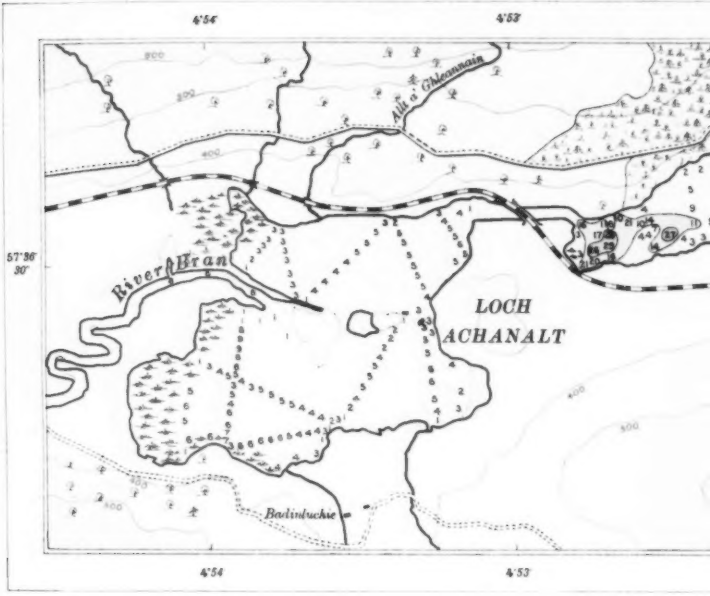
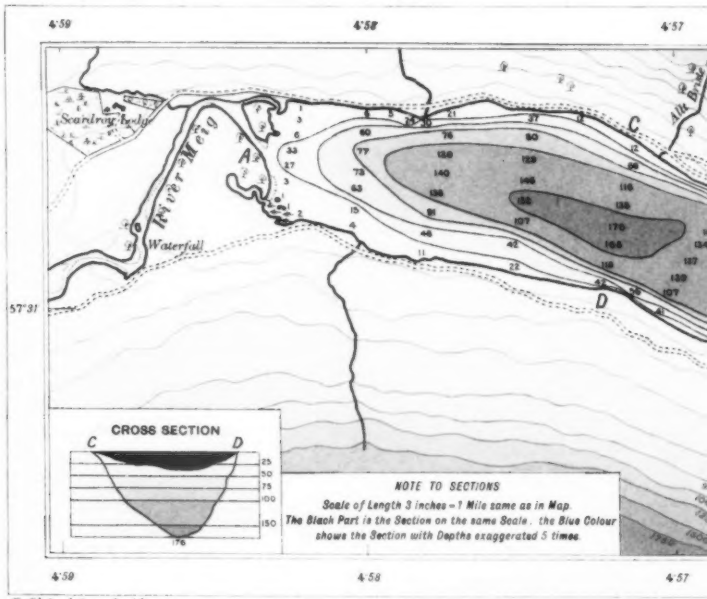
J. G. Bartholomew.

PLATE II





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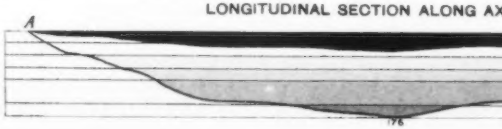
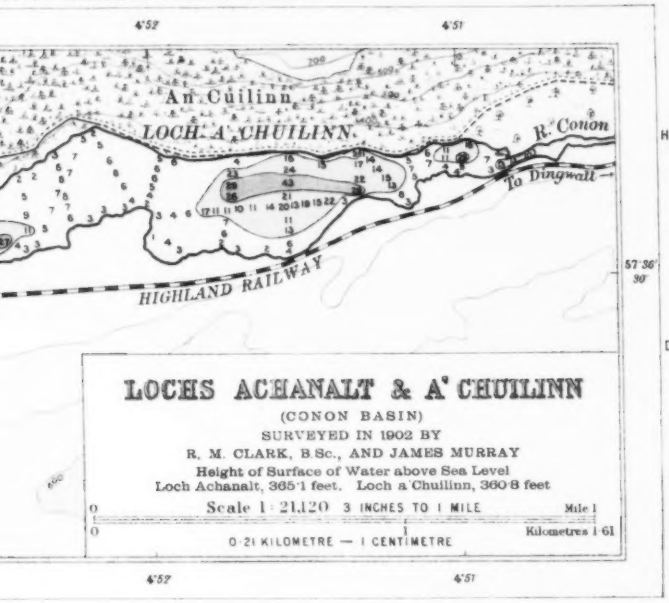
LONGITUDINAL SECTION ALONG AX



FRESH-WATER LOCHS OF SCOTLAND

DIRECTION OF
C., AND LAURENCE PULLAR, F.R.S.E.



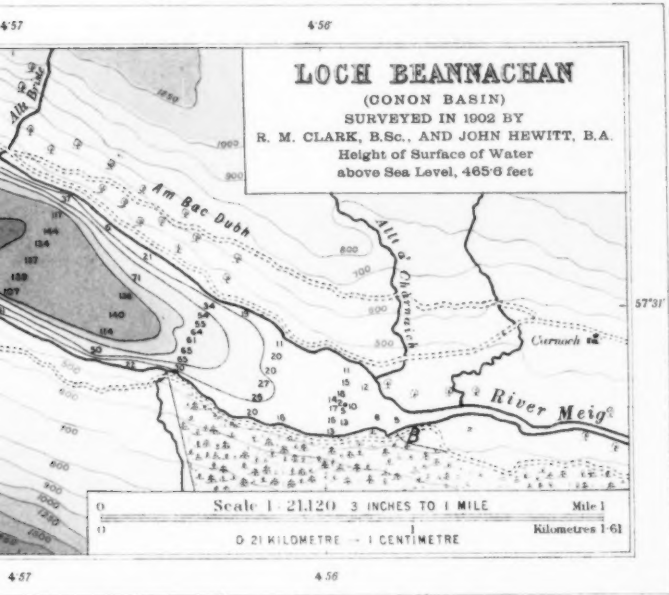
HEIGHTS IN FEET

FEET	METRES
700	213·4
600	182·9
500	152·4
400	121·9

DEPTHS IN FEET

FEET	METRES
10	3·05
25	7·6

The Land Contours are from the Ordnance Survey



HEIGHTS IN FEET

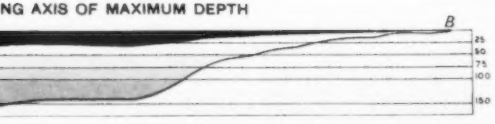
FEET	METRES
1750	533·4
1500	457·2
1250	381·1
000	304·8
900	274·3
800	243·8
700	213·4
600	182·9
500	152·4

DEPTHS IN FEET

FEET	METRES
25	7·6
50	15·2
75	22·9
100	30·5
150	45·7

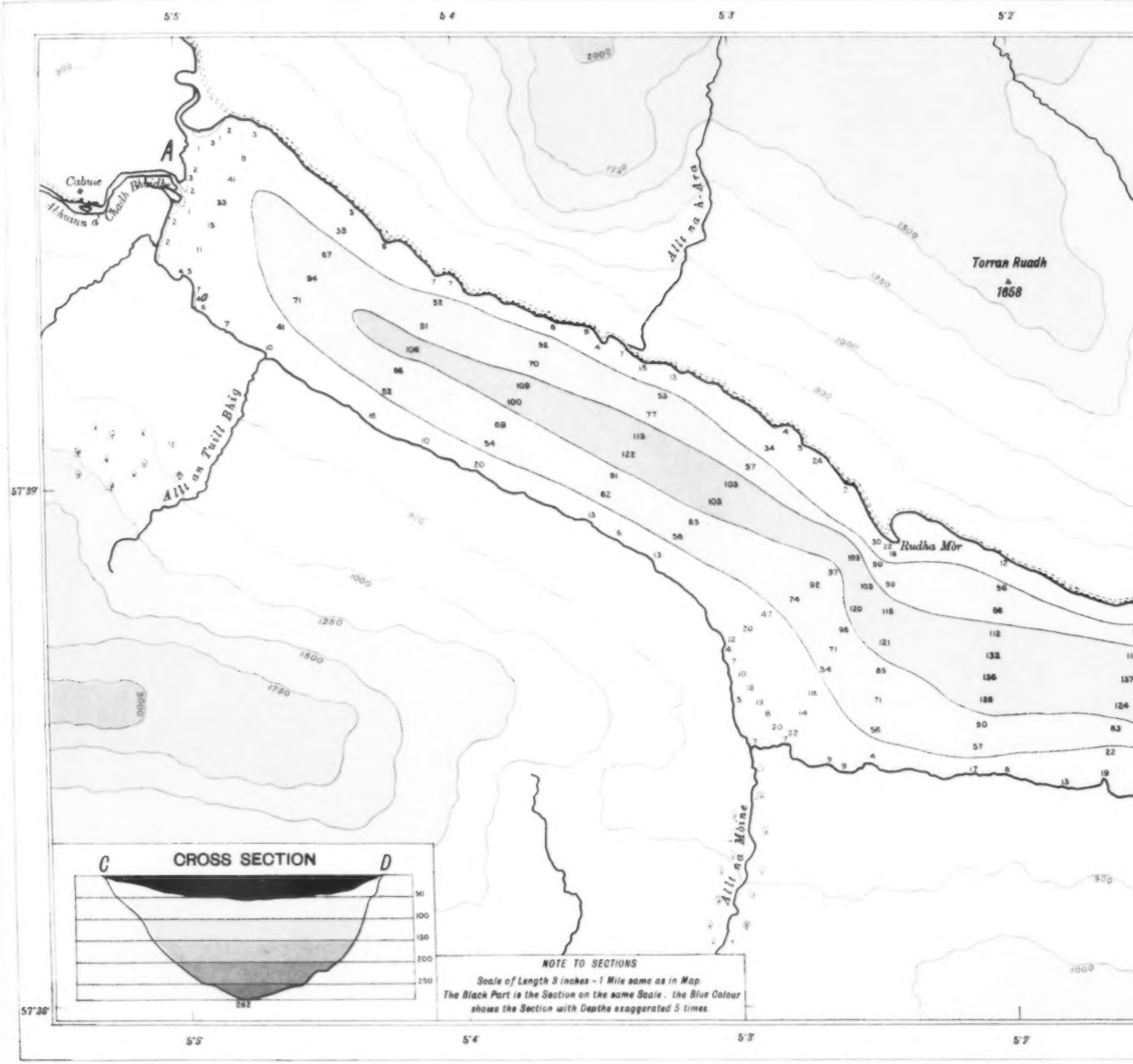
J.G. Bartholomew

NG AXIS OF MAXIMUM DEPTH



l Geographical Society.

PLATE III



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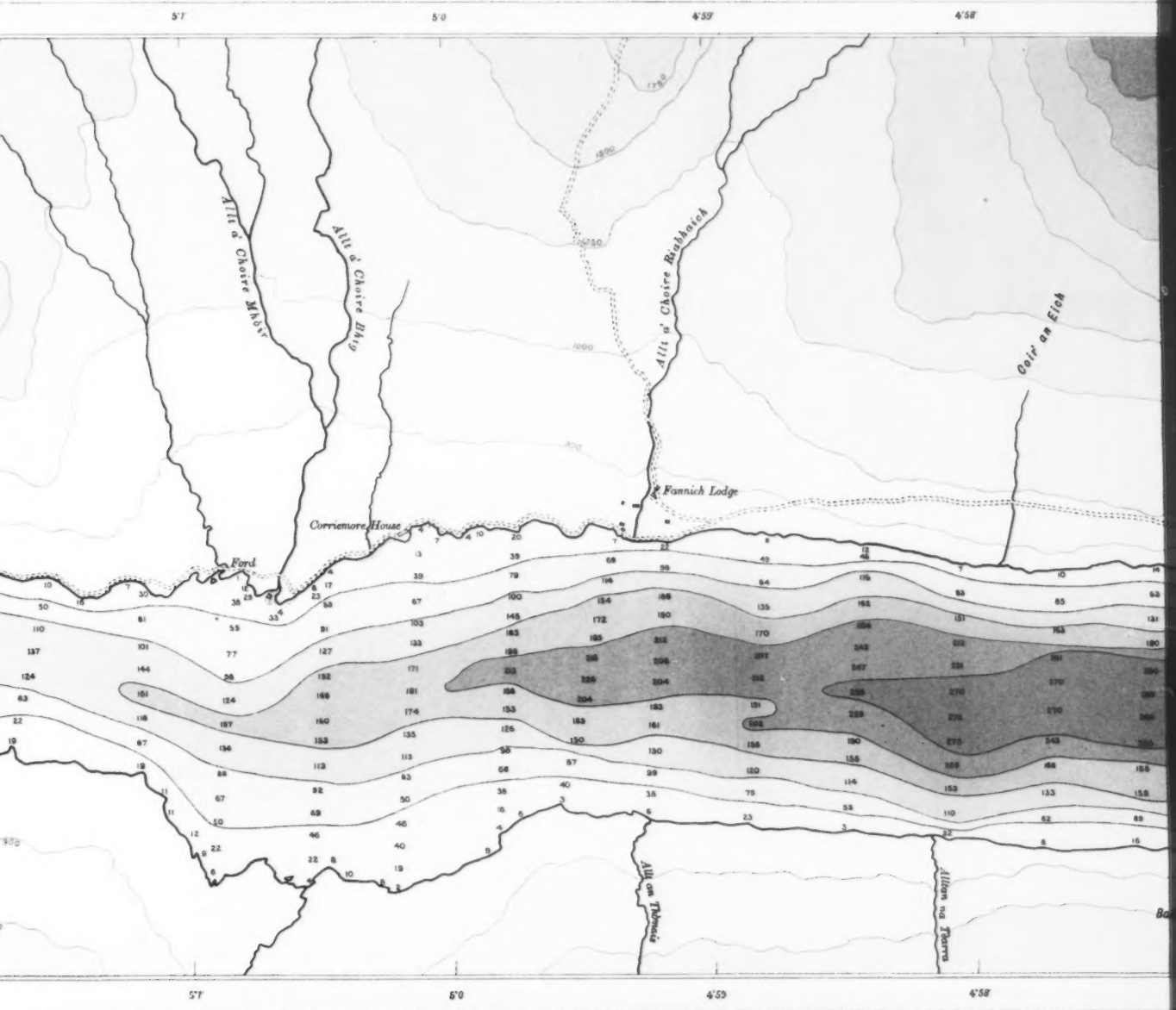
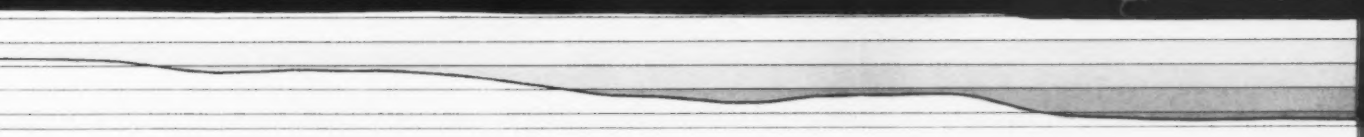
YMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH



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SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

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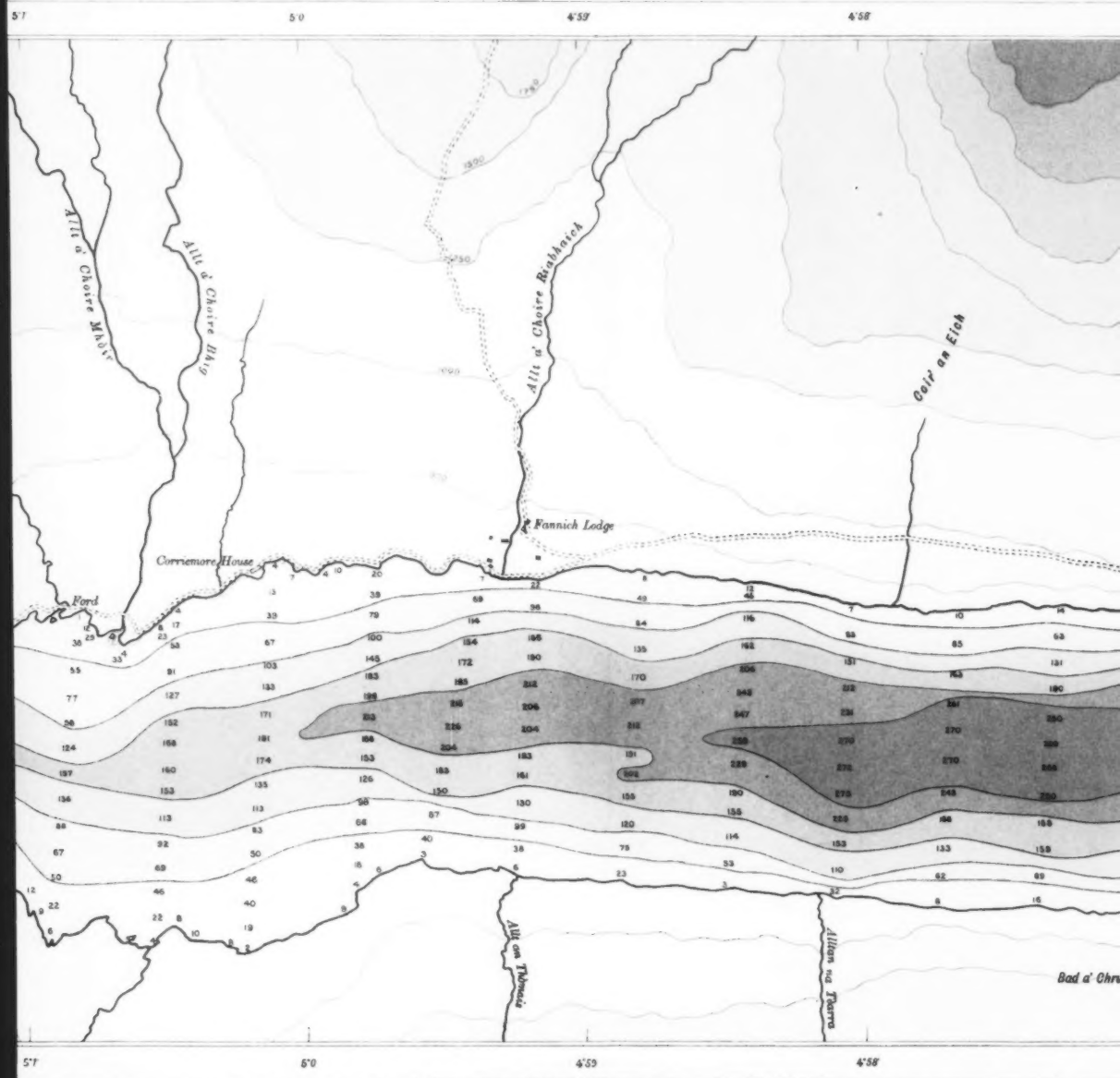

LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH

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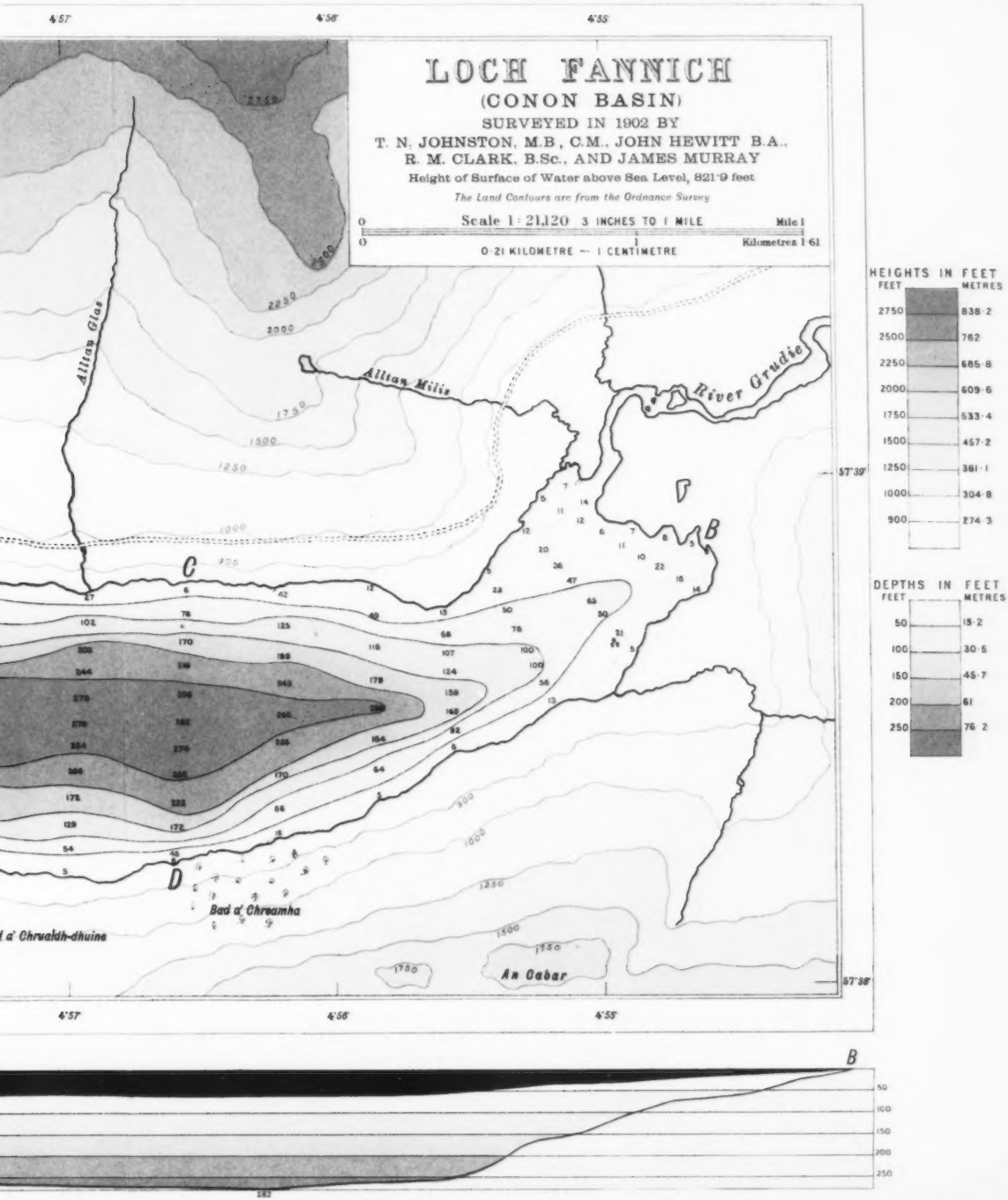


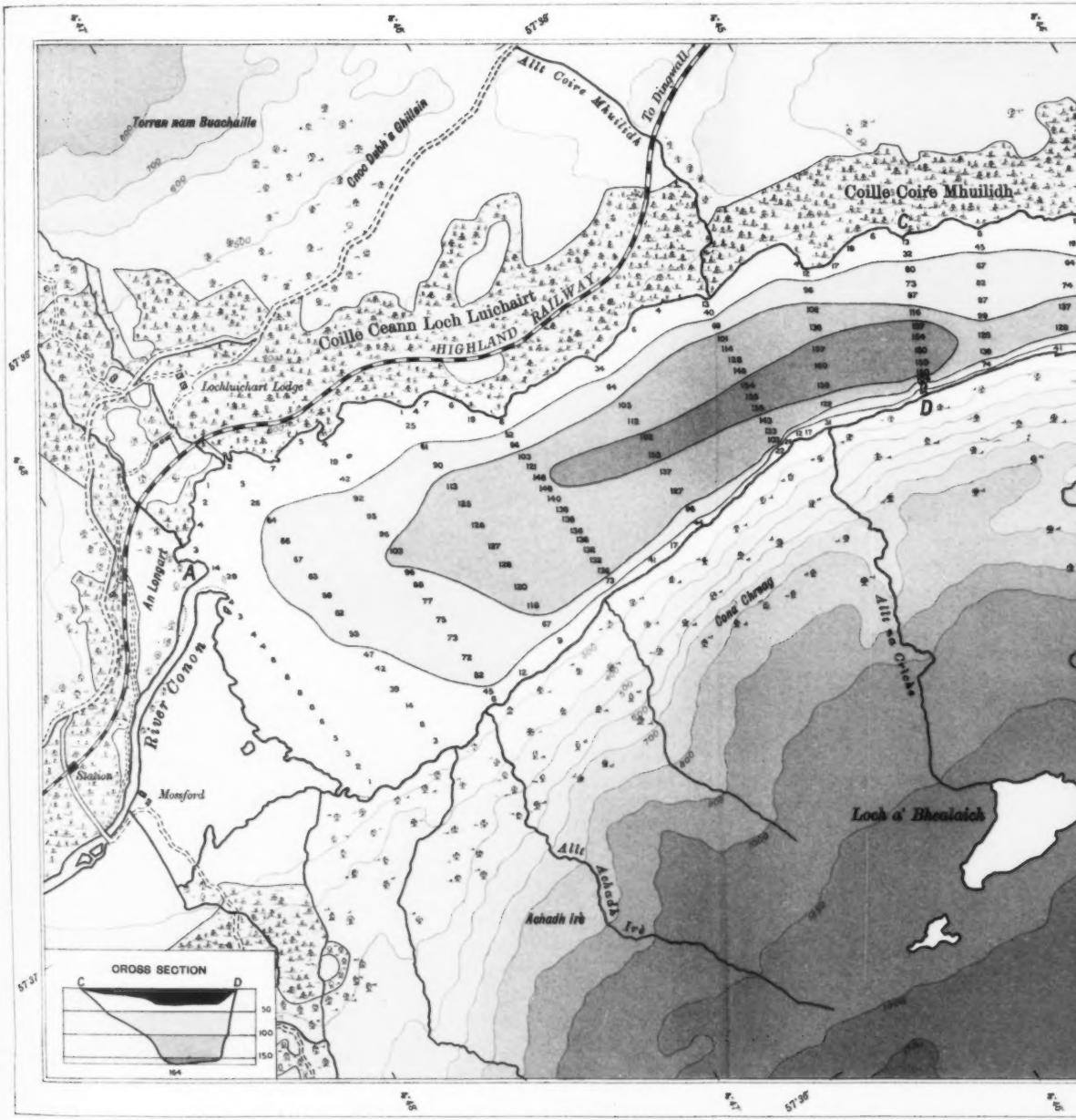
J. G. Bartholomew

BATHYMETRICAL SURVEY OF T

UND

PLATE IV

SIR JOHN MURRAY, K.C.B., F.



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THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

..., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.

LOCH LUICHART

(CONON BASIN)

SURVEYED IN 1902 BY

T. N. JOHNSTON, M.B., C.M., JOHN HEWITT, B.A.,
R. M. CLARK, B.Sc., AND JAMES MURRAY

Height of Surface of Water above Sea Level, 249·8 fe...

The Land Contours are from the Ordnance Survey

Scale 1 : 21,120 3 INCHES TO 1 MILE

0·21 KILOMETRE — 1 CENTIMETRE

Leitir Bhreacaig

Poll Gleibhais

Creag Mhór

Arrieleurach

Glenmarkie

Allt a' Ghlinne

Sgurr Mairc-suidhe

AL SECTION ALONG AXIS OF MAXIMUM DEPTH

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TRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCO

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.

LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH

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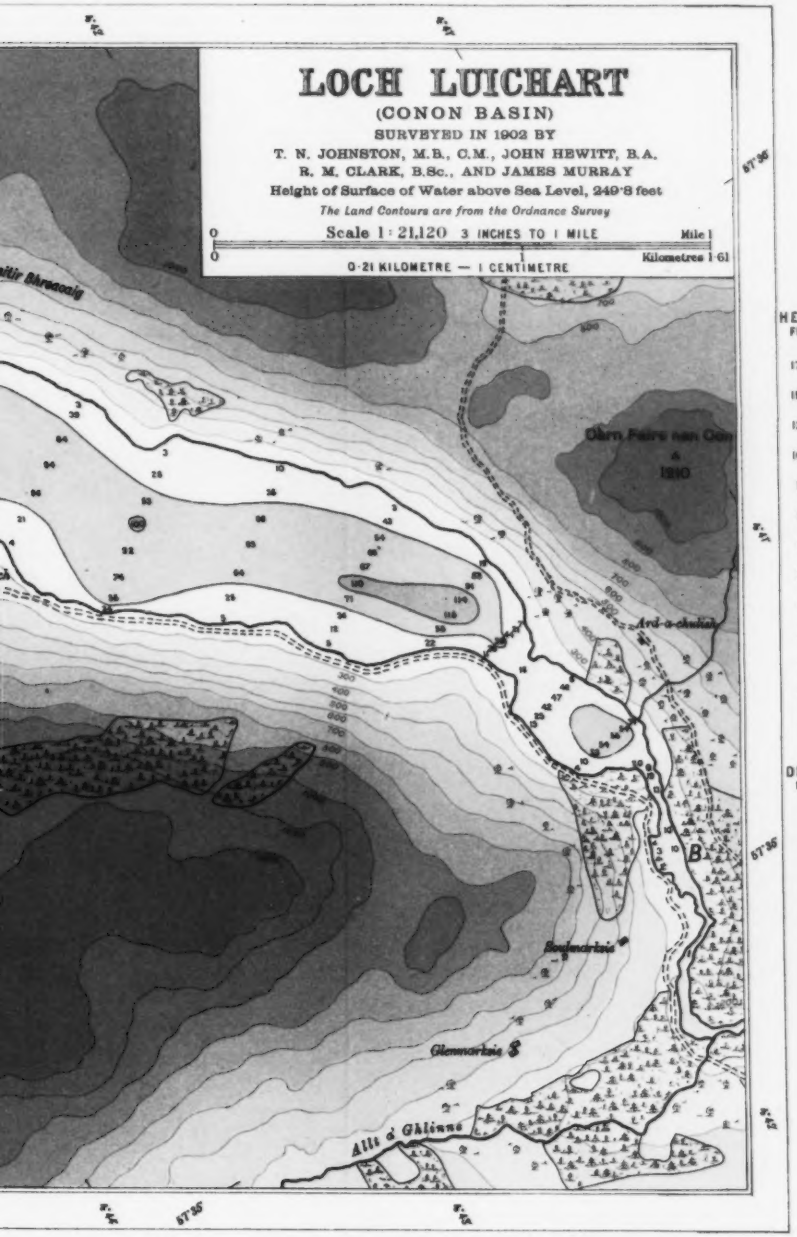
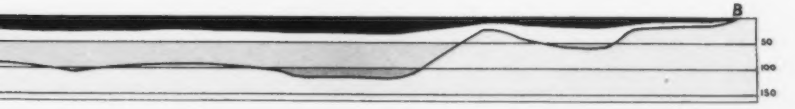




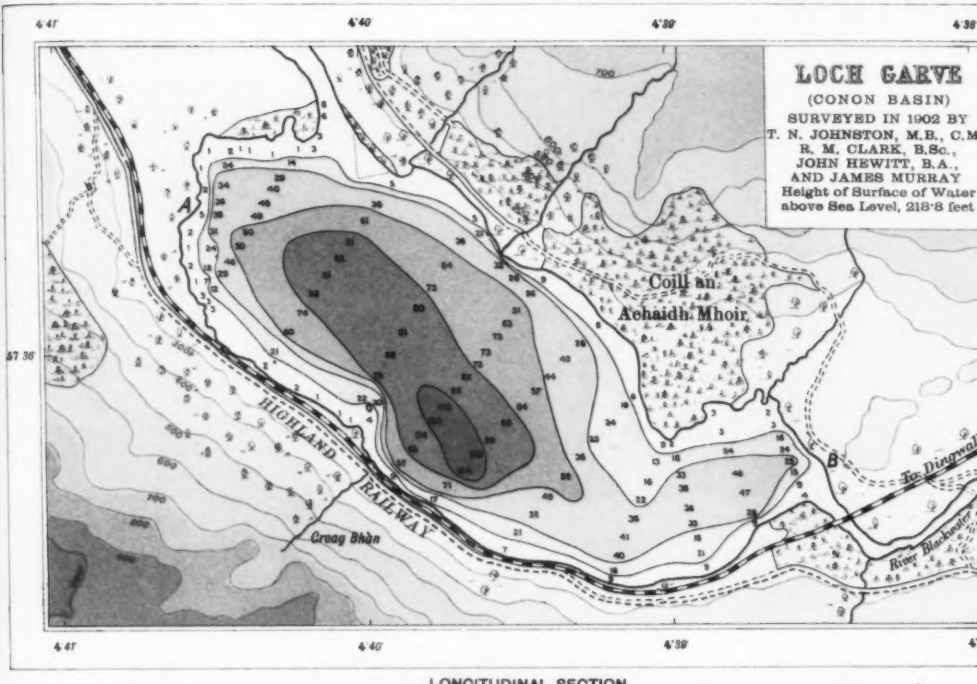
J. G. Bartholomew.

BATHYMETRICAL SURVEY OF THE FRESH-WA

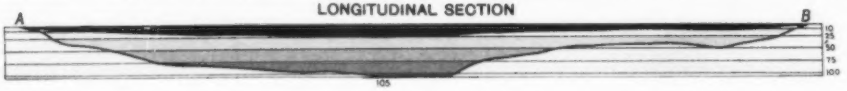
UNDER THE DIRECTION OF

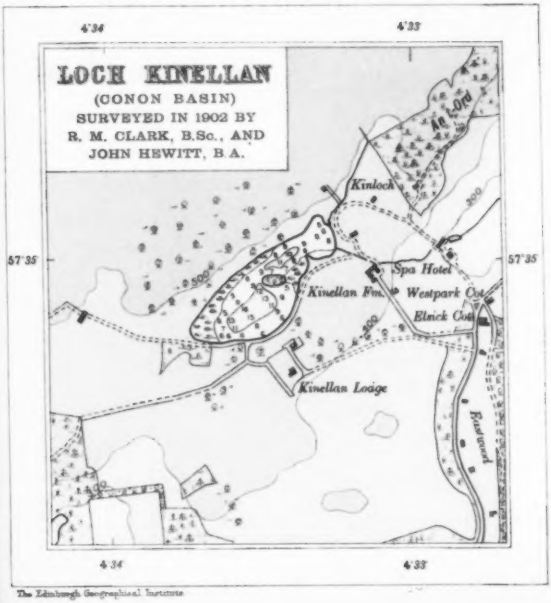
SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAUR

PLATE V



LONGITUDINAL SECTION





NOTE TO SECTIONS

Scale of Length 3 inches = 1 Mile same as in Map.
The Black Part in the Section on the same Scale: the Blue Colo
shows the Section with Depths exaggerated 5 times.

The Land Contours are from the Ordnance Survey

Scale 1 : 21,120 3 INCHES TO 1 MILE

0·21 KILOMETRE — 1 CENTIMETRE

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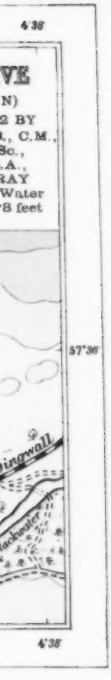
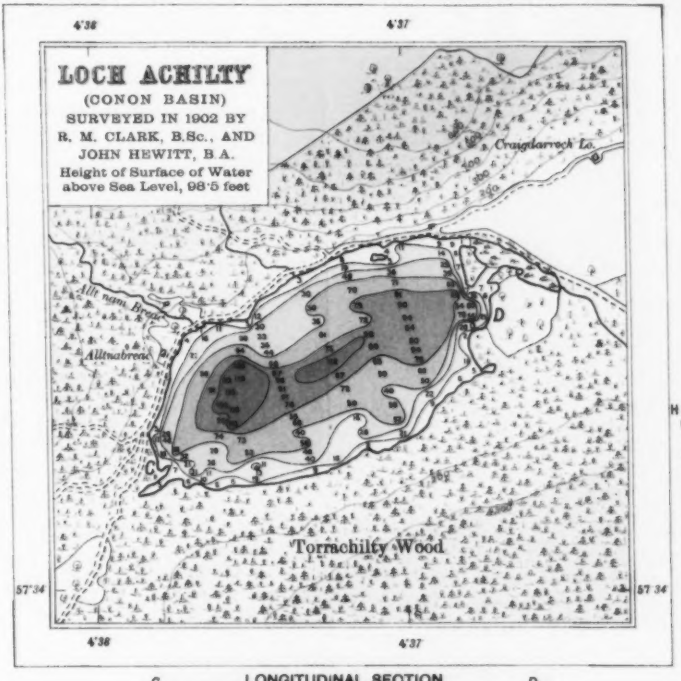
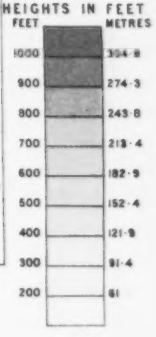
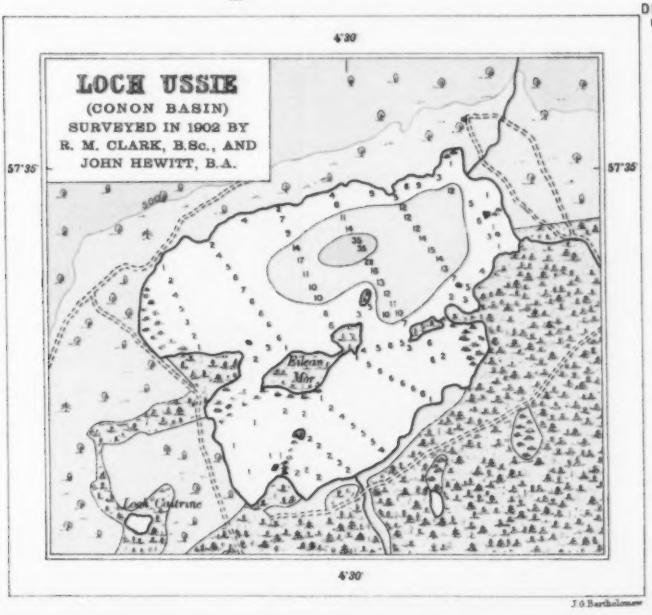
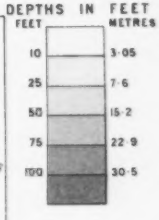










Blue Colour
imes.

Survey

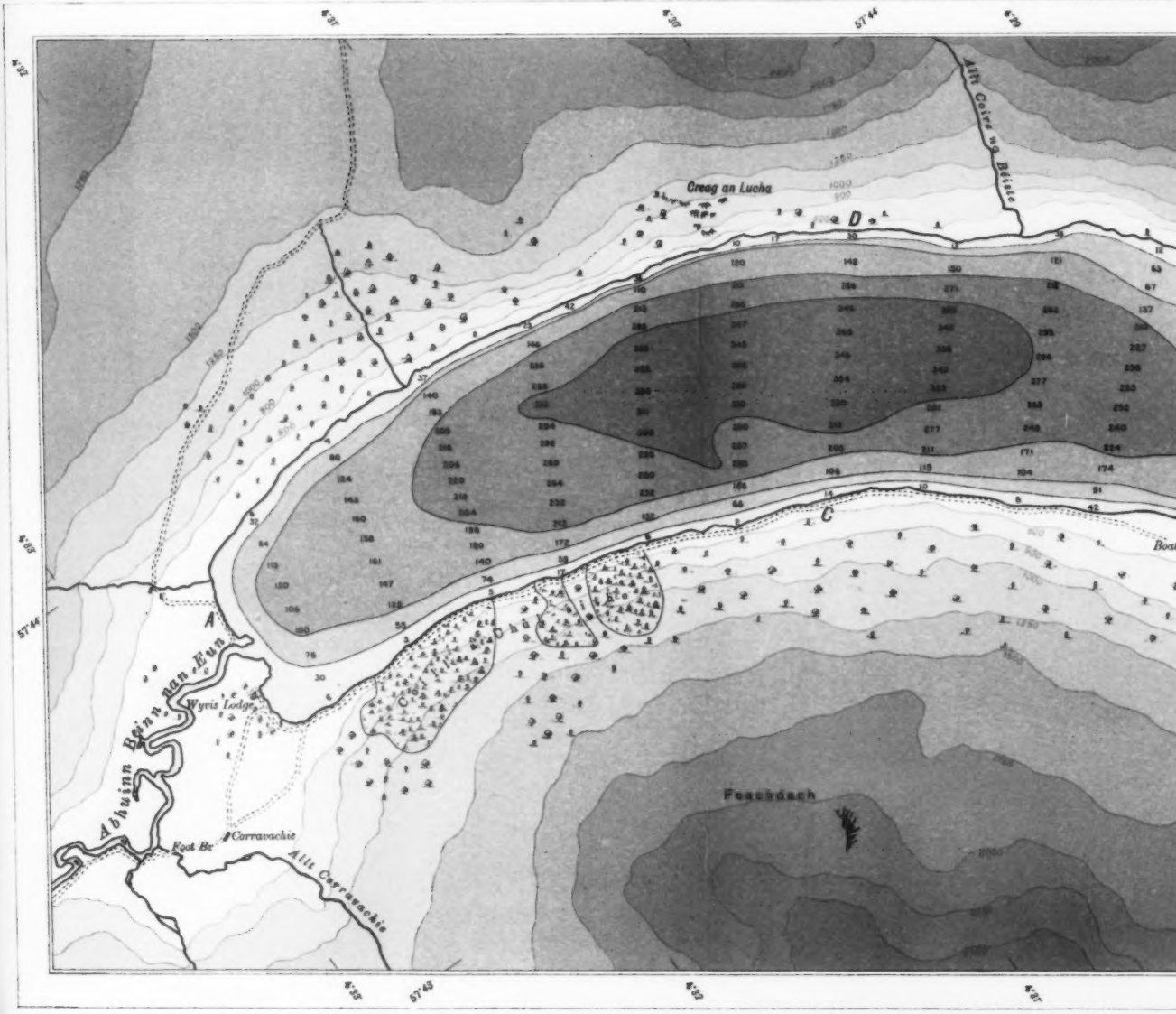
MILE
Mile 1
Kilometres 1·61

BATHYMETRICAL SURVEY OF THE FRESH-W

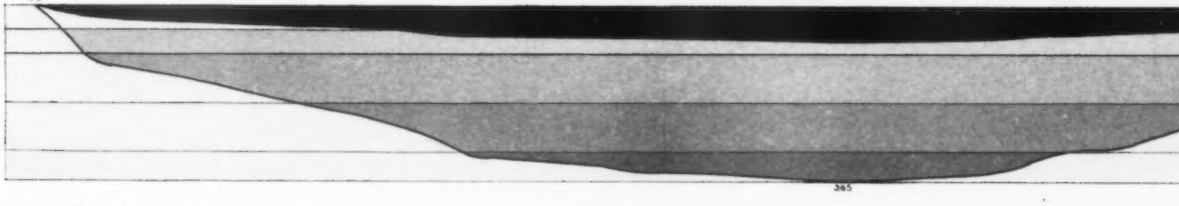
UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAU

PLATE VI



LONGITUDINAL SECTION ALONG AXIS OF



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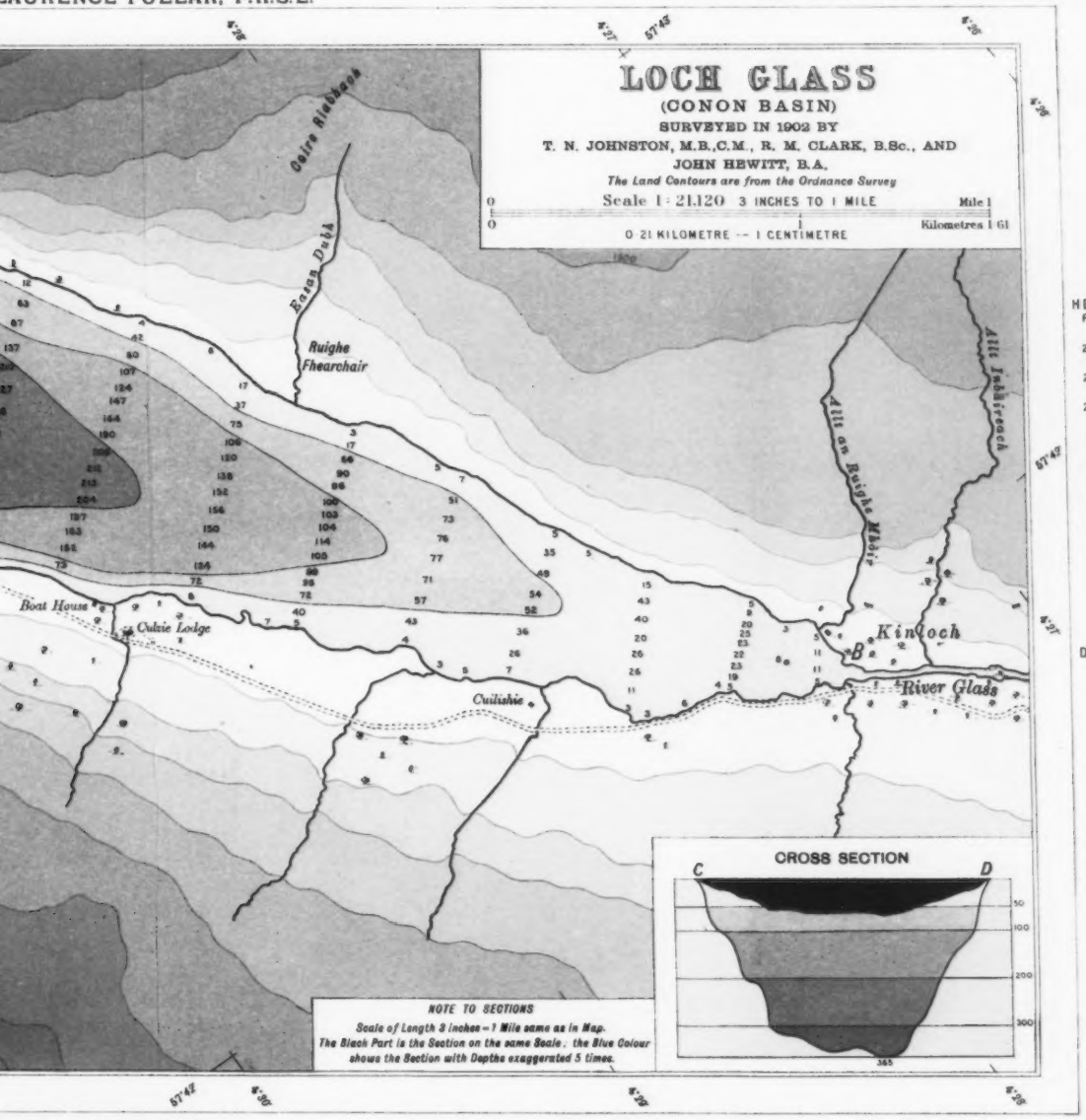
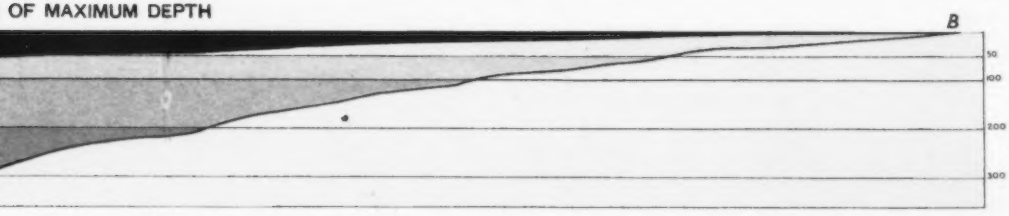
H-WATER LOCHS OF SCOTLAND

OF

LAURENCE PULLAR, F.R.S.E.



OF MAXIMUM DEPTH



hical Society.

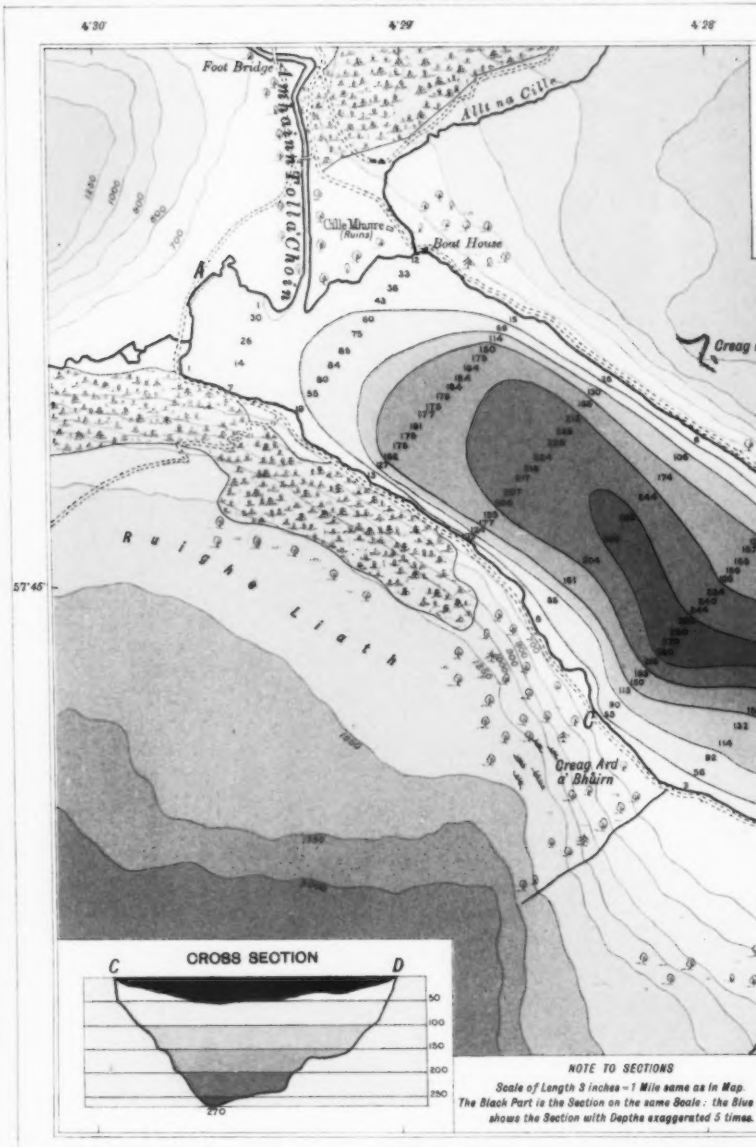
J. G. Bartholomew.

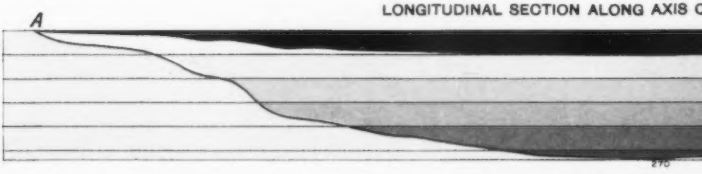
BATHYMETRICAL SURVEY OF THE FRESH-W

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LA

PLATE VII





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SH-WATER LOCHS OF SCOTLAND

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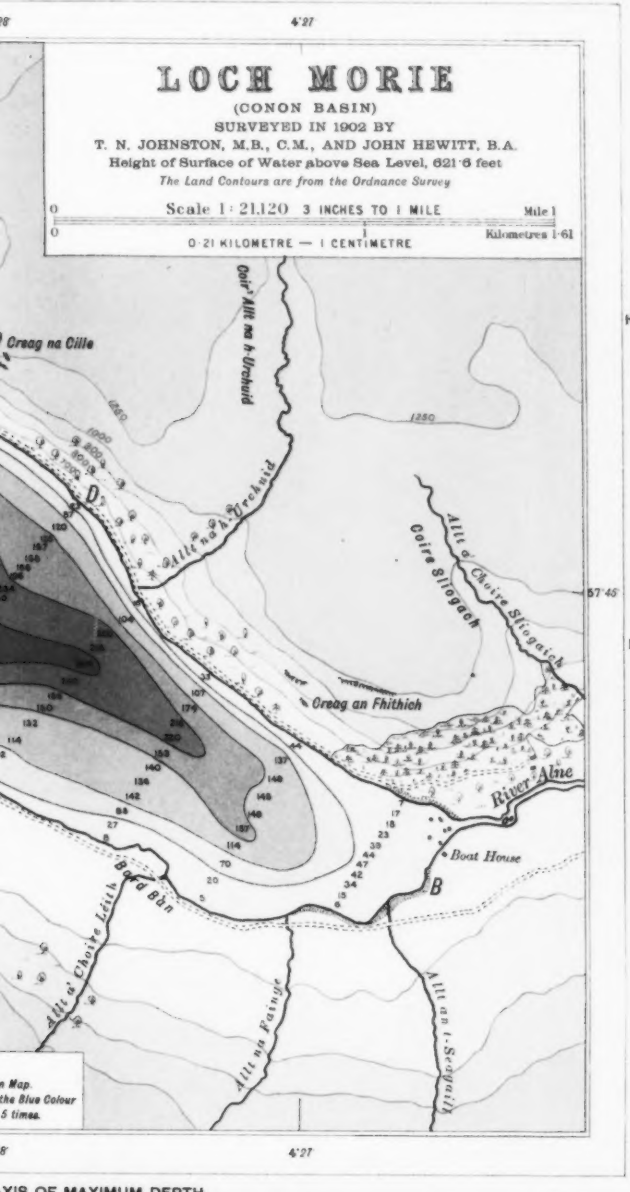
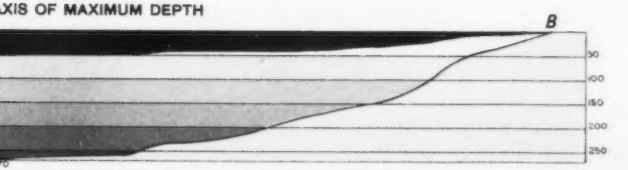
ND LAURENCE PULLAR, F.R.S.E.

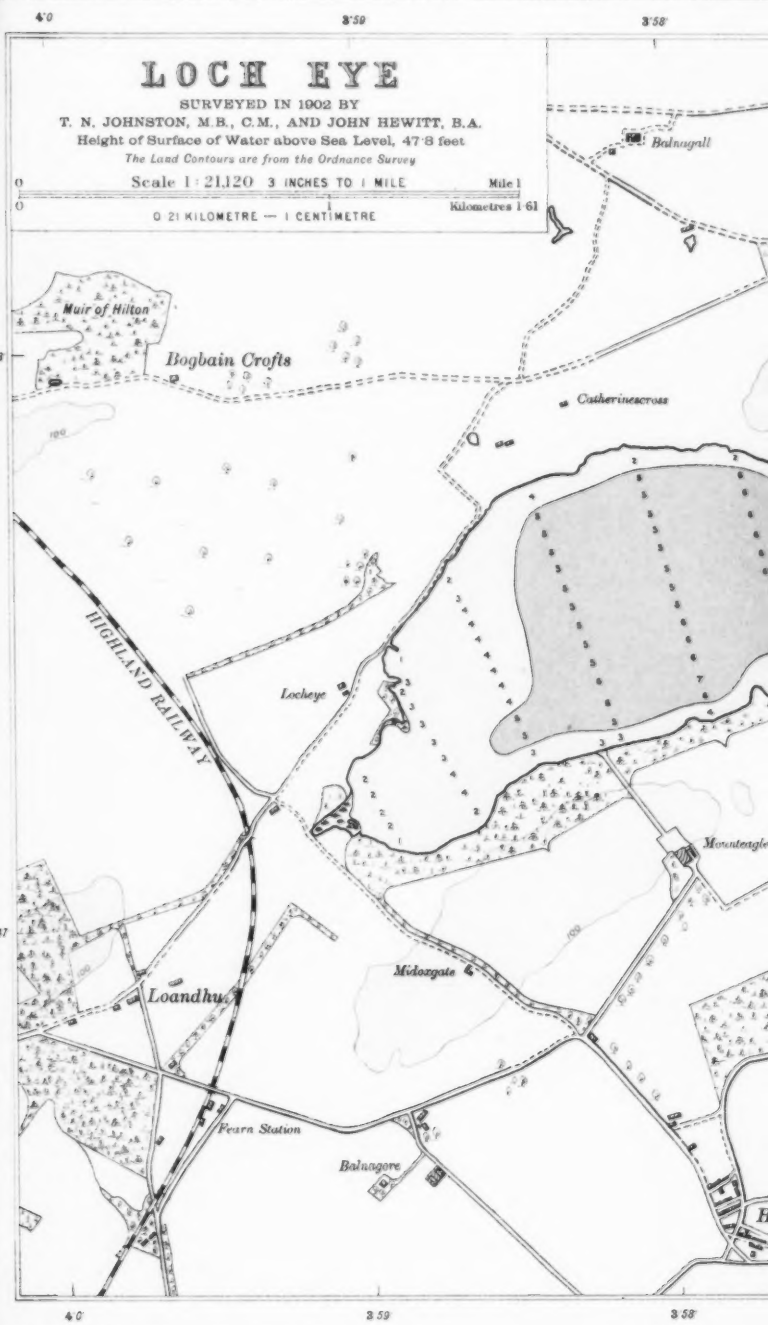


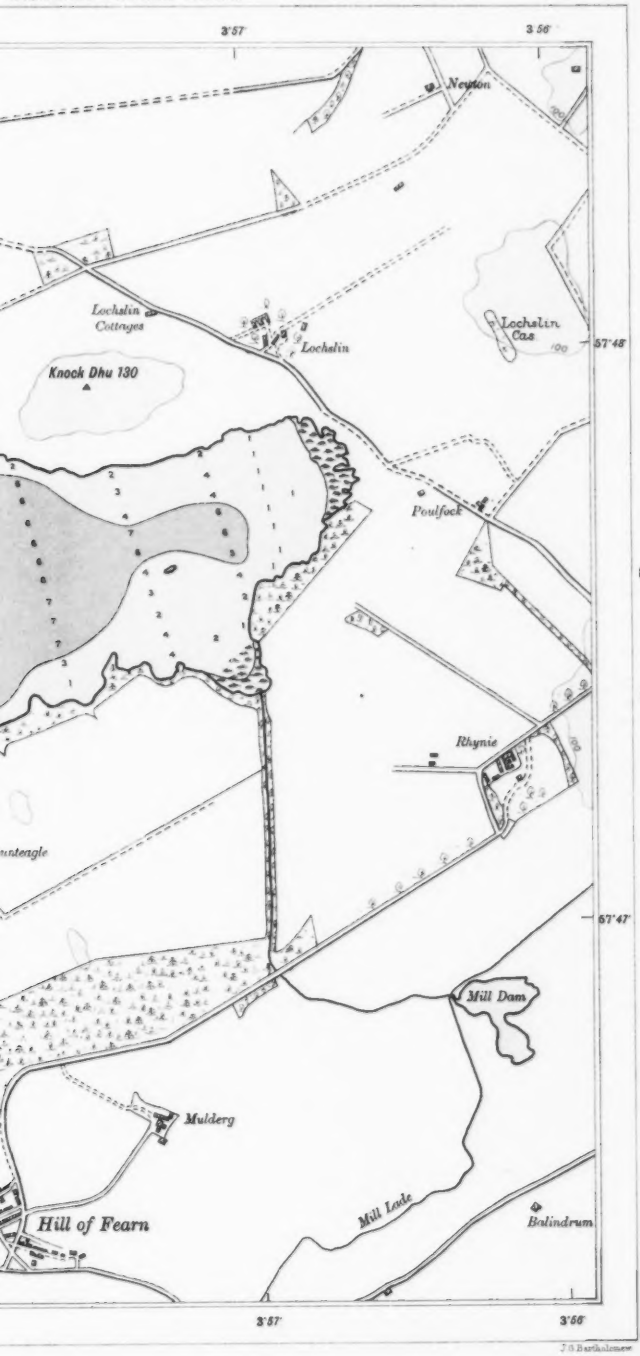
AXIS OF MAXIMUM DEPTH



graphical Society.

J. G. Bartholomew


4'0
3'59
3'58
LOCH EYE
SURVEYED IN 1902 BY
T. N. JOHNSTON, M.B., C.M., AND JOHN HEWITT, B.A.
Height of Surface of Water above Sea Level, 47·8 feet
The Land Contours are from the Ordnance Survey
Scale 1 : 21,120 3 INCHES TO 1 MILE
Mile 1
0 21 KILOMETRE — 1 CENTIMETRE
Kilometres 1·61
Balnagall
Muir of Hilton
Bogbain Crofts
Catherinescross
HIGHLAND RAILWAY
Locheye
Mountcragle
Midorgate
Loandhu
Fearn Station
Balnagore
57° 48'
57° 47'

H-WATER LOCHS OF SCOTLAND

OF
LAURENCE PULLAR, F.R.S.E